Vol. 7, No. 1 JULY 1931

First Copy

The FLEET OWNER

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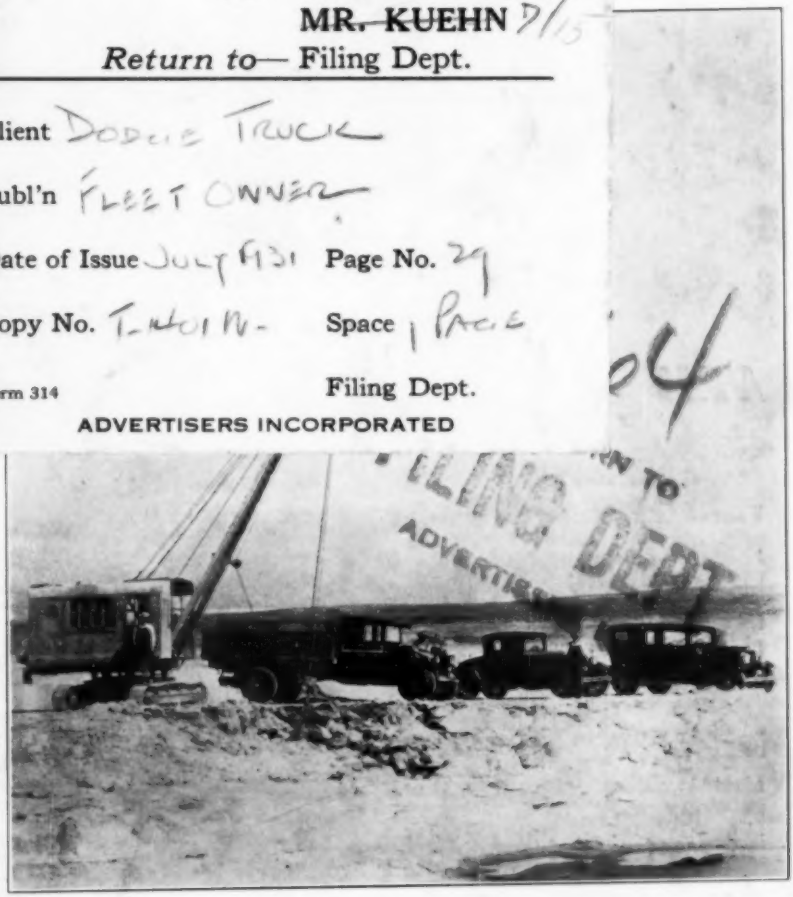

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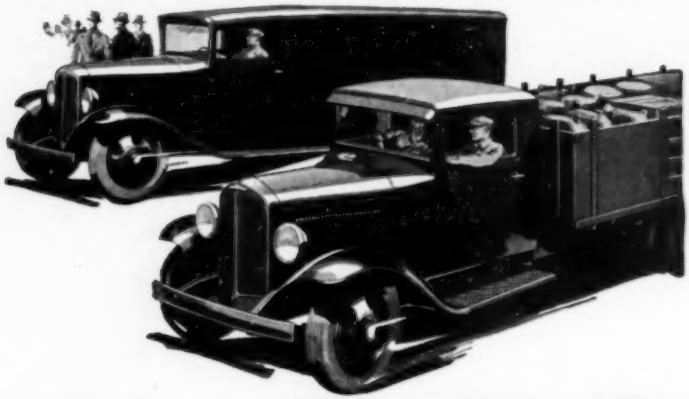

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DUAL WHEELS EXTRA

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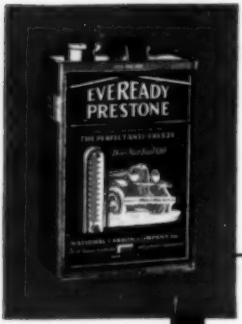

PROTECTION

on the road or in the air

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National Carbon Co., Inc.
Kansas City, Mo.

Gentlemen:

I wish to take this opportunity to advise you of our experience and the satisfaction we have been able to obtain during the past two seasons from your product, "Eveready Prestone", as an anti-freeze solution for our water-cooled motors.

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CARE WILL SAVE YOUR CAR

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Operating an air-line or fleet of trucks or buses is a *business* — not a game of chance. If you gamble with makeshift anti-freezes, you may have to pay heavy repair-bills. Eveready Prestone is the safe, sure, scientific product that more and more fleet-owners are using.

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2. Does not boil off.
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8. Prevents formation of rust in cooling system.
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1,500,000 Miles

Not one hour of tire trouble on the road!

Remarkable Record of 150 Trucks of Safeway Stores, Inc. on Firestone Truck Tires

FIVE HUNDRED TONS of foodstuffs to move every single day—150 tons of perishable goods—meats, butter, fruit, etc. Such produce must be delivered without delay—must be delivered rapidly to guard against spoilage. Speed is *vital!*

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1—Gum-Dipped Cords—add 58% to the flexing life of each cord.

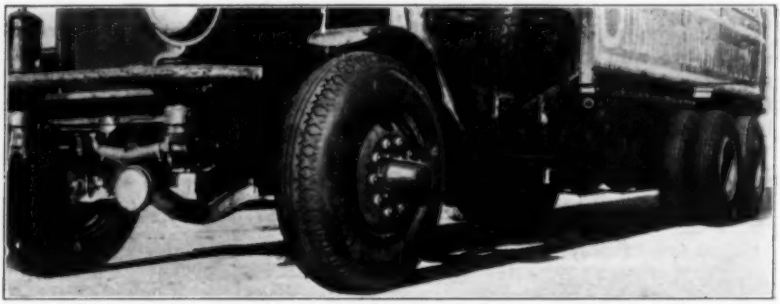
2—Patented Double Cord Breaker—gives 26% greater protection against blow-outs and 56% stronger union between tread and cord body.

3—Tougher, wider, deeper-grooved tread—gives 25% longer non-skid life.

This results in 25% to 40% longer tire life and quicker trips through increased speed with safety which assures on-time schedules without delay.

During a period of twelve months, these Firestone Truck Tires covered a total of 1,500,000 miles and *did not have one single hour of tire trouble!*

Your nearby Firestone Service Dealer will gladly tell you how Firestone Truck Balloons can save money on your trucks. Telephone him today.



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MOST MILES PER DOLLAR

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The FLEET OWNER

Service Their Own"

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President

A. L. CONLEY
Sec. and Treas.

Subscription
$1.00 Yearly

HENRY CLAY FISCHER
Editor

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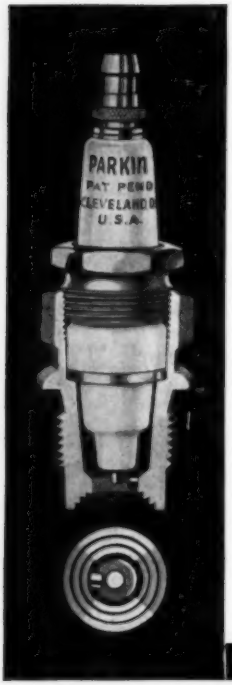
PARKIN



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$4 AND THIS COUPON BUYS BOX OF 10 PARKIN PLUGS

Please ship me a sample box of Parkin Spark Plugs.
Metric ( ) 7/8ths ( ) for $4 and this coupon. Also send me the name of the nearest Parkin Jobber.

*Name*_____

*Address*_____

*City*_____ *State*_____

*My Jobber*_____

The FLEET OWNER

"For Those Who Service Their Own"

PUBLISHED monthly in the interests of Automotive Fleet Owners who maintain their own Repair and Service Shops, and devoted to the better operation and maintenance of Trucks, Passenger Cars, Busses and Taxis.

HENRY CLAY FISCHER, EDITOR

Vol. 7 **New York, July, 1931** **No. 1**

Passenger Cars in Every Fleet

ONE of the interesting things about our fleet operation industry is the fact that there are a certain number of passenger cars in every fleet—whether the fleet consist of motor busses operating on our city streets, or whether it consists of trucks operating in the Wyoming desert, as portrayed this month on our front cover.

Unfortunately, the picture does not show the entire fleet. Two of the passenger cars, presumably belonging to executives, happened to be on hand at the time of taking the photograph. Of course there are more trucks in this fleet, but when the picture was snapped they were where they should be—on the road delivering the goods.

In this connection it is also interesting to note that this particular fleet is used in mining sodium sulphate, or "natural soda" as it is called, which product is used extensively in the manufacture of glass, paper, paint, medicines, etc. The soda, after being extracted from the lake beds is loaded wet into the fleet of trucks and carried to drying sheds, from whence it is shipped to distributing points in carloads.

Many people are under the impression that the words "fleet

owner" mean operators of trucks only. In our many contacts with the fleet industry we find an increasingly large number of passenger cars used in connection with truck and bus fleets—for executives, salesmen, paymasters, inspectors, etc. That the passenger car is indispensable to fleet operation of any kind has been proven time and time again. Add up the number of passenger cars that are sent into the shop for service and perhaps the result will surprise you. It certainly has surprised us.

The Best is None Too Good

TIRE prices still seem to be the lowest in the history of the automobile industry and the poorest grades cost so nearly as much as the best, that there should be no question in the fleet operator's mind as to what grade it is best to purchase.

There is no question but that the better grades of standard brand, first-line, heavy-duty tires will give the best results. Why jeopardize operation schedules with inferior brands to save a *very few* cents, when you can assure yourself of maximum satisfaction by buying the best, *first?* To repeat, tire prices are low. Buy the best and buy them while they are cheap.

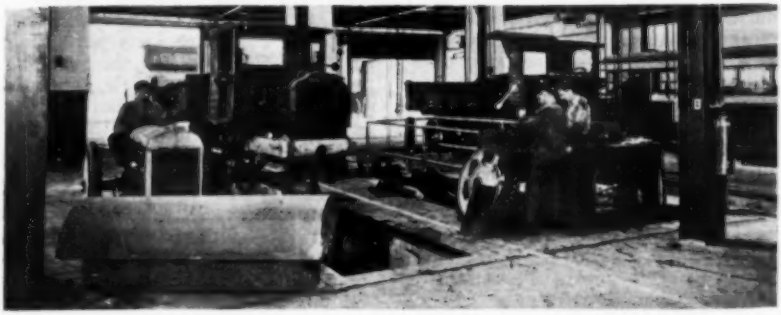
Your Vote is Needed Here

FIRST let us extend our best thanks to those readers who have already written in to us, telling us their preference as to the *physical size* of this publication. Here's what it is all about:

A controversy has arisen in which it has been suggested that we change the size of *The Fleet Owner* to a larger size book that would measure 9 x 12 inches over all. Our other alternative is to continue it in its present *pocket* size. Which would *you* prefer?

Please write the Editor a short note, stating your choice in this matter. Of course, your letter will not obligate you in any way. We want to get an idea as to just which size would be more popular among our readers. Which shall it be? Write us today, please. Thank you!

The Editor



Modern Maintenance *Methods*

Constructional and Preventive Maintenance Applied to a Fleet of 2,100 Automotive Vehicles

By **H. B. Hewitt** *

THE subject of fleet maintenance methods embraces such a diversity of applications that I am going to refer only to my own experiences and accumulation of data pertaining chiefly to motor coaches.

The basis of maintenance methods depends upon the character of the service and expected life of the vehicles. In one case, it may be desirable to maintain the fleet to a high degree of efficiency in order to obtain uniformly satisfactory service over a long period of time, so that the depreciation would be a low figure and the maintenance at a comparatively high figure.

In one of Mitten Management's operations, city type single-deck and double-deck buses are depreciated upon the basis of an expected life of 10 years. Some of these buses are now in their sixth year and their condition indicates that they will give satisfactory service for the full period of ten years or longer.

For other types of buses, particularly the long distance parlor coach type, it is sometimes desirable to have a high depreciation and relatively low maintenance cost in order to be prepared to meet obsolescence or competition of a different type of vehicle if it should become necessary. The maintenance under this method will be performed so that the buses will be kept in good operating condition, so that at the end of the depreciation period, if it was not considered necessary to replace the equipment, the depreciation could be extended and operation credited.

As a third method, where operating conditions are such that all costs

---

* *Engineering Assistant to Vice-President in charge of Operation, Mitten Management, Inc., Philadelphia, Pa. This article was recently read before the National Association of Motor Bus Operators.*

must be reduced to the absolute minimum, buses would be purchased at a low first cost depreciated over a comparatively short period and maintenance work done on a hand-to-mouth basis only as may be found necessary to keep the buses in service in a safe operating condition.

There are so many variable factors involved in determining how money apportioned for maintenance can be spent most economically, that this can rightfully be considered an engineering problem.

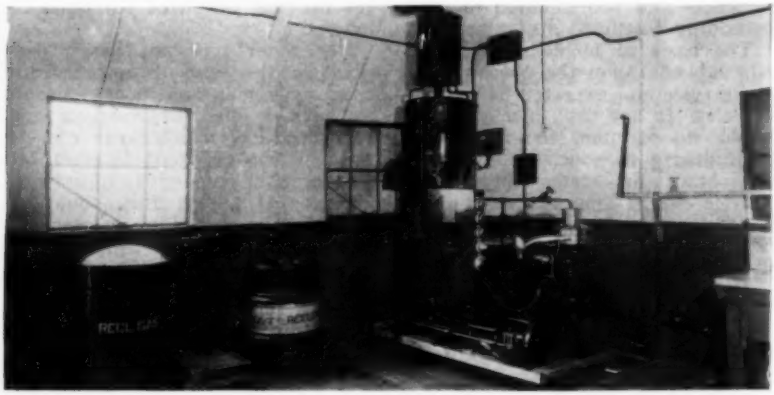
In the past it has been customary to set up plans for the maintenance of automotive equipment without an engineering study, upon a definite mileage basis, such as changing the oil in the crankcase every 1,000 miles—change spark plugs every 10,000 miles, etc. This procedure was undoubtedly found to be effective at the time workmen were inexperienced and skilled repairmen were difficult to obtain.

With the development of measuring devices providing accurate means of obtaining facts pertaining to the condition of the various parts of the motor vehicle, it would seem that the proper method for determining the time to make repairs, adjustments or replacements, etc., should be based on existing conditions and facts, rather than upon a measure of time or distance. Under this method, men developed to be diagnosticians rather than inspectors would determine the amount of repairs and the time the repairs are to be made.

Men with sufficient experience and good judgment (sometimes called "horse sense") who can determine accurately the proper time to make an adjustment, to change the oil, or replace a part, are of inestimable value to any bus operation.

It is my opinion that hundreds of thousands of dollars have been needlessly spent for maintenance based strictly upon mileage or time.

The first time the thought oc-



The reclamation of crankcase drainings is a very fertile field for savings. (Editor's Note—This equipment is typical, although the picture was not taken in the author's shops.)

ISN'T THIS *the* TRUTH?

When you put repair money into your motors you are simply buying new mileage at so much per mile. If you buy this mileage *piece-meal*, you *cannot escape the high costs of piece-meal repair work.*

There is no economy, for instance, in letting your shop put new rings into worn pistons that will probably have to be "pulled" after several thousand more miles. Replace the worn-out pistons and pins when you replace the rings and you buy new mileage at lowest wholesale costs.

The new parts you install are important, too. If you insist on Thompson Products you'll be sure of the best your money can buy.

THOMPSON PRODUCTS, INCORPORATED

General Offices: Cleveland, Ohio, U. S. A.

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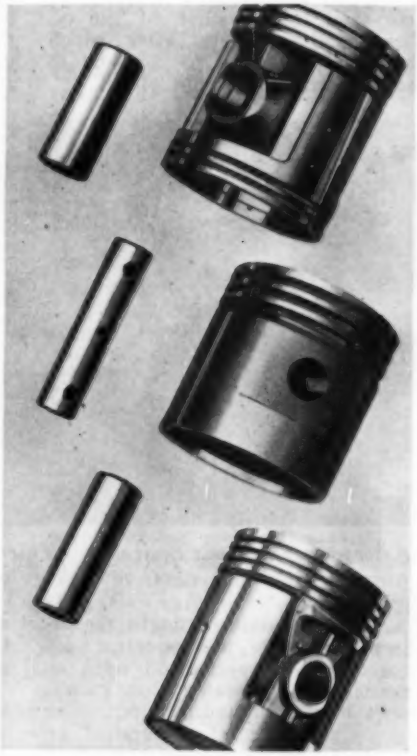
Thompson Valves and Guides; Pistons and Pins; King, Shackle, Tie Rod Bolts and Bushings; Eccentric Tie Rods; Tryon Shackles.



Thompson Pistons

Always use Thompson Pins with Thompson Pistons

curred to me of the benefits that might be obtained by changing the maintenance methods was upon a visit to a taxicab operation where I saw a workman draw a sample of oil from a taxicab crankcase into a glass bottle. He held the bottle up to the light to examine it for color and the presence of sediment. He then rubbed some of the oil between his fingers, after which he okayed the cab to continue in service without change of oil.

reboring the cylinders, a most convincing argument that the maintenance methods in this shop were practical. This is probably an extreme case, but in principle will serve to illustrate the method of maintenance I am suggesting.

Unfortunately, bus operations have not all attained efficient handling and servicing of equipment; therefore, as the manufacturers suffer through failures they are forced to adopt protective meas-

Exhaust gas analysis equipment. This apparatus has done much to effect fuel and lubrication economies

A few questions brought the information that this operator did not change crankcase oil until an examination indicated that it was very dirty or it had lost its feeling of oiliness. The first thought on my part was "how does this affect the life of the engine?" Fortunately, I made no comment at that time. Soon afterward, the operator showed me engines which were being fitted with piston rings after running over 90,000 miles without

ures by adding weight and strength to their vehicles in order to stand abuse and poor maintenance.

For the last three years buses of the same outside dimensions and seating capacity have increased in weight approximately 33⅓% but have decreased in cost per pound approximately 33⅓%. The engine power has been increased approximately 300% and various other changes have been made which have considerably improved the

performance of the new vehicles which are unquestionably much better buses.

In spite of the many changes in design, increased weight and improved performance, the buses available today still fall short of equaling automobile performance with respect to acceleration, speed, comfort and maneuverability.

When operators can obtain buses that give the public the performance they desire most, speed and comfort, they will be on more nearly equal terms with their greatest competitor, the privately owned automobile.

It is not the purpose of this article to discuss the future bus, but it is difficult to pass over the necessity for many radical changes in order to permit buses to maintain their position in passenger transportation. Let us hope that when such a bus arrives it will require only an annual inspection to give uniformly satisfactory service.

Unless a bus is especially designed for the particular service in which it is to be used, there will be numerous modifications which can be advantageously made to improve performance and effect economies. Maintenance engineers can, by analyzing their equipment and accumulating accurate statistics of operation and costs, accomplish results that will greatly improve the economy and reliability of bus operation.

The following comments pertain to methods of maintenance which have been developed for operations under Mitten Management:

Oil Reclamation: Fleet operators, in their constant search for possible savings in operating costs, are looking favorably upon the reclamation of crankcase drainings. This is a very fertile field for savings and after 3 years' experience in using reclaimed oil, I do not hesitate to recommend the installation of oil reclaiming equipment to operators of motor vehicles. In Philadelphia, there is a central oil reclaiming plant which has a capacity of 200 gallons of cylinder oil per day, and in addition, wiping rags are washed and woolen waste from subway and surface car journals is reclaimed. The costs for 1929 were as follows:

Cylinder oil—motor coaches and taxicabs	11c per gal.
Wiping rags	4c per lb.
Woolen waste for car journals	3c per lb.

Transportation charges between the central reclaiming plant to the garage and storerooms are included in the above costs, so that comparison can be made directly with new material delivered to the same points.

This plant in 1929 had the following production:

Cylinder oil	30,000 gal.
Fuel oil	10,000 gal.
Waste	100,000 lbs.
Wiping rags	27,000 lbs.

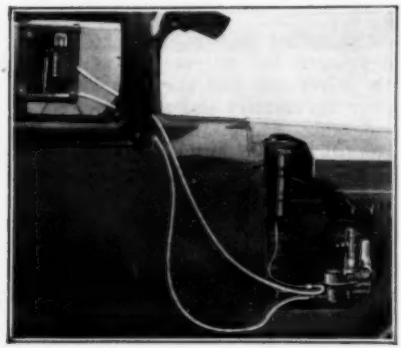
Carburetion: Carburetor settings or adjustments which are adopted as standard by manufacturers are developed for universal service, as the buses are sold for operation all over the country and there is a considerable variation in operating conditions such as speeds, loads and grades. Such a carburetor setting is one of the compromises mentioned above.

Daily fuel expense, when figured cumulatively for millions of miles of operation show possibilities of savings which are astounding to operators who have not been accustomed to handling such figures. In one of Management's operations the annual mileage is 9,336,654. An increase of one-tenth of a mile

average per gallon effects a saving of $14,614.00 per year. A great deal can be accomplished by replacing the guess method of setting carburetion by scientific methods through the use of instruments for accurate measurements. In some of the smaller operations where money is not available for the more expensive instruments, a very simple device for attachment to the bus for road testing can be used. In larger operations, more accurate methods of measuring carburetion by exhaust gas analysis is desirable.

After analyzing the route or service in which a particular bus or group of buses is to be used, it is advisable to adopt a carburetor setting which will give the best operating economy. This is not always the best fuel economy, as under some conditions increased power at a sacrifice of fuel economy will produce an operating economy which will more than offset the increased cost of fuel.

As an example, a bus route 5 miles long requires 6 buses to maintain a proper schedule with an economy carburetor setting; by changing to a power setting, 5 buses can maintain the schedule, thereby effecting an annual saving of $7,488.00. The increased fuel consumption of the 5 remaining buses amounts to $3,810.00 or a net annual saving of $3,678.00 for this bus route. On other routes, the traffic congestion may be such that maximum speed is less desirable than acceleration; therefore the carburetor setting is changed accordingly. The P.R.T. Automotive Laboratory is equipped with exhaust gas analyzing equipment as shown in the picture on page 14.



In smaller operations, this simple gasoline-mileage tester can be used for providing accurate figures

The horizontal meter in the center indicates percentage of incomplete combustion from measurement of carbon monoxide plus hydrogen (CO+H2) which is converted upon a chart to percentage of carbon monoxide (CO). The recording instrument in the lower center is used for long tests or where a graphic record is desirable. The mercury manometer on the left of the panel indicates back pressure in the exhaust pipe of the engine under test.

Tires: Many bus operators can make considerable savings by carefully analyzing their tire costs and average tire mileage, having in mind the following important factors:

Underinflation reduces tire life and reduces gasoline mileage. On one type of bus a drop of 10 lbs. in air pressure in 38 x 7 tires at 30 miles per hour increases the pound loss 3 HP.

Incorrect wheel alignment shears away the tire tread and reduces gasoline mileage. On a good brick road a change of toe-in from 0 to ⅛" will create a loss of 1.125 HP

Surest..Easiest..Most Accurate Way to

Reduce Operating Costs

VISCO-METER certifies Correct Lubrication . . . Protects, Prolongs Motor Life

The first step toward motor economy is correct lubrication. By correct lubrication we mean the kind of protection that provides a smooth-running, long-lasting motor, with minimum repairs and maximum oil mileage.

Visco-Meter assures just this kind of performance. By continuously indicating the lubricating value (i.e. viscosity) of the motor oil under actual operating conditions, Visco-Meter shows at a glance exactly how the oil is behaving. No more guesswork; no more lubrication "on faith." The true lubricating quality of the oil is known at all times while the motor is running . . . Visco-Meter makes it possible to get the maximum mileage safely out of every quart of oil.

Send the coupon to Visco-Meter Corporation, 318 Grote Street, Buffalo, N. Y. Detroit Branch, 6-247 General Motors Building.

The VISCOMETER

Takes the Guesswork out of Motor Lubrication

Visco-Meter Corp., 318 Grote Street, Buffalo, N. Y.

Gentlemen:—

Please send me full details on Visco-Meter, including the new booklet "A Practical Test for Viscosity."

Name .....

Address .....

City .....

and ½" toe-in result in 4½ HP loss.

A 1" drop at a vehicle speed of 16 miles per hour nearly doubles the static load on the wheel alone. A check on one of Philadelphia's streets by actual count of one hundred drivers, only twenty-five tried to avoid a hole in the pavement.

A study of the tire failures on long distance high speed buses resulted in figures showing a very high percentage of failures upon the inside tires of the rear dual wheels. A survey of the routes over which these buses traveled found a considerable crown to the road surfaces. It was therefore reasonable to believe that the inside tires were overloaded. As a further check upon this condition temperatures of the tires were taken and the air pressures checked. The table on this page shows the results of this investigation.

You will note that the right rear inside tire shows a 50% increase in air pressure at the end of 45 miles.

As a result of this investigation, the cold tire air pressures were reduced and the inside tires were inflated 10 lbs. less than the outside tires. These changes resulted in an immediate reduction of tire failures and greater average tire mileage.

Some operators do not seem interested in tires that are bought on mileage contracts but they should realize that manufacturers base their mileage rates upon operating conditions and experience and reduce rates upon good experience, similar to the practice of insurance companies, who reduce their premiums according to past experience.

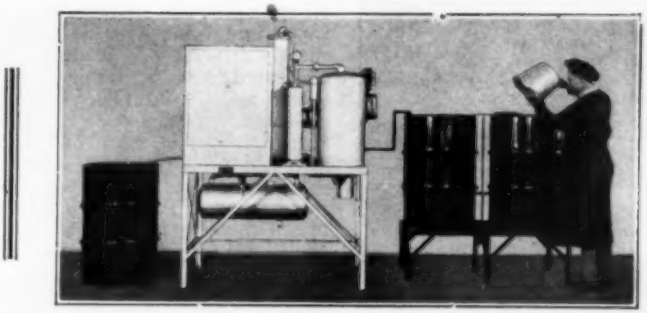
On one of the bus operations under Management over a period of three years the payments for damaged tires were reduced 78% and the mileage rate 35% largely through improvement in operating conditions and the experience gained by the tire manufacturers holding the contract.

Engine Temperatures: A group of 150 buses was equipped by the manufacturer with thermostats in the engine cooling system and a 4-blade radiator fan. Upon investigation it was found that the power required to drive the fan was 11.5 horsepower at 2000 R.P.M. The thermostats were removed and two blades of the fan were cut off, resulting in 5.5 Horsepower being required to drive the fan at 2000 R.P.M. Satisfactory cooling was obtained and an additional 6 horsepower previously used to drive the fan was available to propel the bus. The design of the original fan is obviously a compromise, made necessary by the wide variation in

(*Please turn to page 61*)

TABLE OF TIRE AIR PRESSURES

	Garage	32 Miles	45 Miles	100 Miles
Left Front	70	85	90	90
Right Front	70	90	95	95
Left Right Inside.....	65	85	85	90
Left Right Outside....	70	80	85	90
Right Rear Inside....	70	100	105	100
Right Rear Outside...	70	90	85	95



More About Oil Reclaiming

Fire Protection Engineer Gives Timely Advice on the Proper Operation of Oil Reclaiming Machines

By R. M. O'Connell*

THE lubrication of internal combustion engines has presented problems that have constantly changing factors. Changes in motor fuel characteristics may in part be responsible for some of the variable conditions that have been experienced.

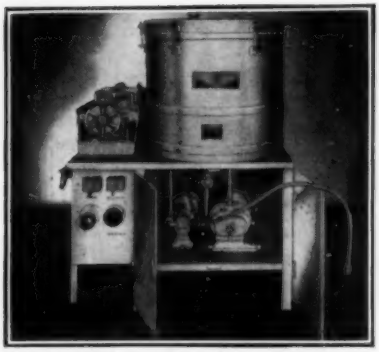
Years ago, nearly all commercial motor fuels consisted of straight run gasolines, with approximately 300° F. end point, that were carefully treated to remove nonvolatile substances. Increasing demands for motor fuels introduced the cracking processes and a gradual change has taken place both in the fuels and in the motors themselves.

Today we have kerosene and distillate engines of various sorts while automobile and truck motors are generally operated with heavy untreated gasolines blended with light natural gas gasolines producing a product with about 450° F. end point.

A portion of this fuel passes the piston rings and finds its way into the oil chamber. The result is that the clear, clean, full bodied oil that was put into the filler tube of the crank case becomes diluted and charged with particles of carbon and other impurities. Contact with the hot cylinder walls produces other changes and the oil is gradually rendered unfit for further use as a proper lubricating medium.

The cost of replacement with new oil and the fact that the crank case drainings may still contain lubricating value have promoted the development of equipments and processes intended to clean and recondition the dirty oil so that it may be used again. These devices are commonly known as oil reclaimers of which there are several sizes and varieties.

* *Division Engineer, Gases and Oils Department, Fire Underwriters' Laboratories, Chicago, Ill.*



The Miller Oil Purifier was originally developed for U. S. Air Service and is now available to fleet operators

Crank-case drainings contain water vapor, solid carbonaceous matter, dust and grit, and lighter oil fractions that have resulted from contact of the oil and motor fuel with the hot cylinder walls. The sludge formed by these impurities is so thoroughly mixed and combined with the oil as to approach a collodial condition. In order to reclaim the useful portion of these crank-case drainings, the suspended or colloidal matter must be wholly removed, as well as the water vapor and volatile hydrocarbons.

Some types of oil reclaimers attempt to do this through filtration, but it has been found that the filtering media soon clog and impractically high pressures are required to effectively remove the sludge in this manner. Filtration alone fails also to remove dilution and lighter oil fractions.

The more common type of reclaimer combines filtration with other processes which are intended to remove the water vapor, lighter oil fractions, and sludge. The water vapor and other volatiles are frequently driven off by heat and either dissipated to the atmosphere or separated and the light oil or distillate collected. The sludge is usually removed by the action of heat and added materials that combine with the foreign particles and settle to the bottom. The hot oil is then filtered, collected, and allowed to cool before it is used again. Some processes are, of course, more elaborate than the above description indicates, but essentially they all attempt to accomplish these results.

As these processes are conducted in certain parts of garages, and other similar locations, from which individual cars or fleets of motor trucks or buses are operated, the use of such equipments, from a fire protection viewpoint, introduce problems in both installation and construction. Fundamentally, these machines, with their attendant tanks and receptacles, may be considered containers for hazardous liquids. Viewed in this light, the tanks or containers for dirty oil, settling tanks, and other similar containers should be constructed, installed, and maintained in accordance with existing regulations covering the class.

In the examination and test of those devices that have been submitted to the Fire Underwriters' Laboratories for investigations, electrical heating elements, motors, switches, cutouts, and temperature control devices have been common. Some types have incorporated a ventilating fan and piping for disposing of vapors outside of the building, while others possess means for condensing and collecting the lighter products that are driven off during the heating period.

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All electrical parts have been required to conform to existing electrical requirements with respect to spacing, protection from mechanical injury, insulation, size, construction, location, etc. Article 33 of the National Electrical Code, applying to garages, requires in general that cut-outs, switches, attachment plug receptacles and fixed lamp-holding devices shall be located at least four feet above the floor.

In the operation of some types of reclaimers, foaming and overflowing of the heated dirty oil and cleansing agents from the still or heating chamber has been known to occur. Such chambers should be provided with unobstructed overflow connections or be otherwise constructed to avoid their escape.

The apparent ignition temperature of gasoline vapors has been determined by test to be approximately 536° F., while that of kerosene vapors has been found to be even lower; 460° F. As the crank-case drainings from several motors are usually collected in a common receptacle, all of the constituents of the dirty oil that are to be introduced into the still or heating chamber of the reclaimer are not definitely known; neither do we know completely what changes and rearrangements of hydrocarbons take place in the still or heating chamber during operation. In view of this, the use of a temperature limiting device has been recommended to avoid the possibility of ignition of vapors and gases within the device or upon their escape and mixing with the outside air. It appears advisable to establish a maximum temperature limitation of approximately 420° F. or less to provide a margin of safety.

The Quigley Oil Classifier, another reclaimer recently introduced

The proper maintenance of filtering media and their safe disposition on becoming clogged, as well as the disposal of vapors and the storing and handling of the reclaimed oil, constitute additional features that oftentimes present problems having a bearing on the fire hazard. It is customary to employ a series of

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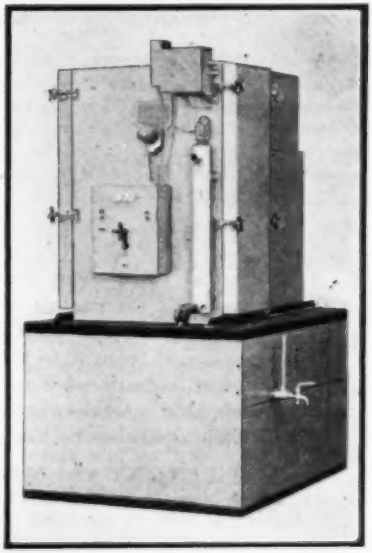
filters and as the first becomes clogged it is removed and the others advanced, a new one being placed in the last position. As spontaneous ignition of clogged, oil-soaked, and improperly discarded filtering pads has been known, manufacturers are counseled to include in operating directions a caution to burn or otherwise safely dispose of them.

In the absence of condensers and tanks for collecting distillates that result from cooling of vapors and gases driven off during the heating period, reclaimers should include provision for conducting the vapors to the outside of the building where they may be readily dissipated. The sludge that is precipitated to the bottom and drawn off following operation of the equipment should not be introduced into the sewer as suggested by the literature that accompanies some types of machines. Existing regulations in some localities prohibit this practice, but they may be difficult of enforcement unless the machine incorporates a sump or settling tank for the accumulation of such refuse. Such sumps or tanks should be cleaned at proper intervals.

While many reclaimers are electrically heated, others are known to employ gas or oil burners. The introduction of open flames into garages, unless the burners are installed in a specially constructed room, may constitute a serious hazard.

In the present stage of the art of oil reclaiming, it appears that an equipment that can be installed with a reasonable degree of care in accordance with existing regulations and which can be readily and safely operated by following the instructions furnished by the manufacturer adds materially to the safety of such appliances. The provision of a construction that will prevent an abnormal discharge of oil or vapors and the ignition of gases, vapors, and other combustibles in the machine itself, or in its vicinity, and which is accompanied by clear and complete installation and operation instructions, should reduce the fire hazard to an acceptable degree.

(Editor's Note: Should any of our readers desire further information, literature and catalogs on the several makes of oil reclaiming machines now on the market, we shall be very glad indeed to see that you are promptly supplied. Drop a line to the Editor and ask for Oil Reclaiming Literature. No obligation, of course.)



The Hilliard Oil Reclaimer. This machine was originally introduced as the "Refinoroil"

Servicing *the* Rear End

Modern Methods in Servicing Rear Axles and Installing Differential, Ring and Pinion Gears

"DEAR EDITOR: We have a Blank truck in our shop with a noise in the rear-end. Upon removing the assembly we found the pinion shaft bearing was bad. After installing a new bearing the noise was still there.

"I personally felt that it had not been adjusted properly, so removed the assembly myself for readjustment. After testing the gears, examining them and replacing the assembly and making another adjustment, the noise is still there.

"When driven on the road the noise comes in very loud when pulling from 10 to 35 miles per hour; at higher speeds it will disappear. It makes no noise while coasting. The noise is a steady, even one, like a trolley car makes when picking up speed under strain. In fact, one of our men says it sounds 'just like a trolley car.'

"We have given the gears a backlash of .010 in. Any information you can give will be of assistance, as we must eliminate this noise."

THE above is but a sample of the many letters we are constantly receiving, requesting information on rear axle problems. In order to minimize these troubles, by enabling our readers to have this information on hand at all times, arrangements have been made whereby this treatise is placed at our readers' disposal.

Through the courtesy of Automotive Gear Works, Richmond, Indiana, the text of their booklet, *"Modern Methods of Differential Drive Gear and Pinion Installation"* is offered in this form. Those of our readers who would rather have this article in booklet form may get a free copy by writing to the Editor of this publication, or the aforementioned company. It will be sent without cost or obligation. A handy digest of the same follows:

ALTHOUGH the installation of drive and pinion gears always has been a job calling for extreme care, the advent of the high-speed, high-torque motor has made it even more essential that the operation be done with the utmost precision.

The shop called upon to do this work should be equipped properly

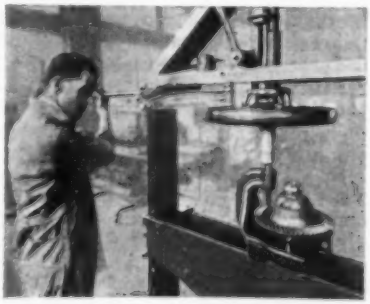


Fig. 1—Removing rivets from ring gear by means of a riveting fixture which can also be used for riveting on the new gear. The fixture is used with a 60-ton press

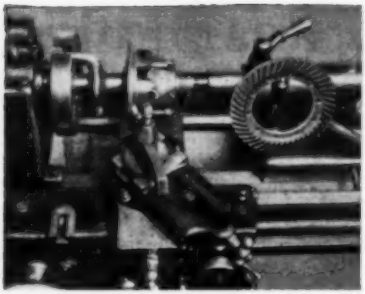


Fig. 2—Taking a light cut off the differential case flange to true it up before attaching the new ring gear

with tools and machinery to duplicate as nearly as possible the standards adhered to by the manufacturer of the car or axle.

Differential drive gear installation and adjustment is a most particular job, and one which should never be done in a haphazard manner.

There must be a minute inspection and check-up of all parts, either directly or indirectly related to the gears. It is the purpose of this article to recommend a method of procedure which we hope and believe will be helpful to any repairman confronted wtih the job of replacing a set of damaged drive and pinion gears.

Replacement of drive and pinion gears is seldom made because of natural wear in the gears or because of defective gears. Instead, replacement is made in the majority of cases because of the failure of some other part or parts related to the gears.

Most gear breakage is due to worn or defective bearings, which allow the gears to get out of alignment. This is particularly true of the bearings supporting the pinion gear. In other cases breakage is caused by failure to lock the bearings properly, thus permitting them to become loose.

There are other causes, of course, but worn bearings beyond doubt are responsible for the majority of drive and pinion gear failures.

For these reasons the following operations of removing the old gears, cleaning the housings, removing old rivets, and inspecting the parts should be painstakingly done, for during these operations the cause of gear failure is generally determined.

In removing the old gears from the rear axle assembly, the mechanic is cautioned not to hasten the operation, but to carefuly remove the necessary parts and inspect them closely, piece by piece.

If the differential bearing caps are not marked, center punch them so they will be put back exactly in the same position as before. Then, when the time comes for replacing the parts, everything is ready and

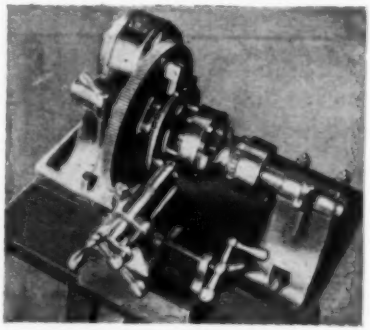


Fig. 3—Truing the differential case flange in a special differential truing machine. Here the assembly is revolving on its own bearing centers

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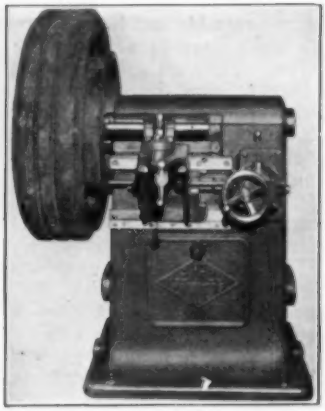

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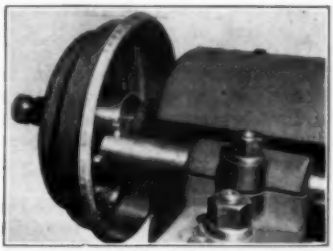

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the re-assembly can be made readily and much more accurately.

The operation of removing an old gear from the differential case flange is most important, as there is a possibility of springing the case by the pressure of removing the old ring gear.

After the differential unit has been removed, the next step is that of cleaning the housing.

The housing should be thoroughly cleaned of all the old lubricant, using kerosene or distillate. Every pocket and corner should be cleaned, to make sure no broken teeth or other foreign particles remain in the housing.

There are several methods for removing the rivets which hold the ring gear to the differential case flange, but the best method and one which eliminates all danger of damaging the differential case is to force out the rivets with a large garage press using a riveting fixture. (See Figure 1.)

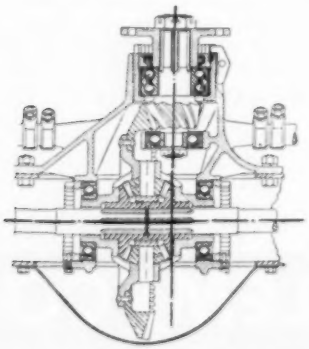

Fig 4—Typical layout of differential drive gear and pinion, showing correct alignment of pinion axis with that of the ring gear

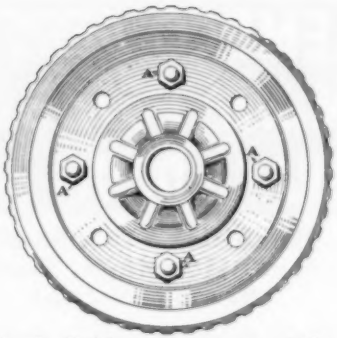

Fig. 5—Bolting on ring gear before riveting. Four bolts are used as at (A) and kept in place until the rivets have been set in the other four holes

In this operation the ring gear and case are supported at three points by a V-shaped fixture, with the rivet to be removed held over an opening in the projecting piece which forms the center support of the fixture.

To remove the rivet, a punch is placed in the upright fixture and pressure applied. This forces the punch centrally through the head of the rivet and pushes the rivet out of place, leaving only a small ring of metal (the rim of the rivet head) on the surface of the ring gear. It is desirable that the garage press used for this operation have a capacity of 60 tons, although a press of lower capacity may be used with satisfactory results.

All of the rivets are removed in this manner, the whole job requiring but a minute or two. Since the same fixture can be used for riveting a ring gear in place on the differential case flange, it is a desirable piece of equipment for the automotive shop.

Another method for removing

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rivets is to drill them out, taking extreme care that the drill is started exactly in the center of the rivet head. Use a drill slightly larger than the body of the rivet and drill from the ring gear side until the drill touches the gear. Then tap out the rivet over a vise with a punch as explained later.

If, through lack of equipment the rivets cannot be removed by the foregoing methods, the ring gear and case can be held in a vise and the rivets cut from the ring gear side with a sharp cold chisel.

With this method ***the ring gear*** is the part to clamp in the vise and ***not the case.*** By cutting the rivets with the ring gear in the vise, the strain of the hammer blows does not affect the differential case, nor will the chisel cut into the soft metal of the case.

After the rivet heads are cut off, the remaining part of the rivets can be driven out with a punch between the jaws of a vise, making sure the case rests squarely on the vise jaws.

With the ring gear off the differential case, the latter should be thoroughly cleaned, and all of its parts carefully inspected.

Extreme care should be taken to look for defective nuts and bolts. Any found to be defective should be immediately replaced with new ones.

Wash the bearings in gasoline—*but be sure not to wash them in the same gasoline used in cleaning other parts.*

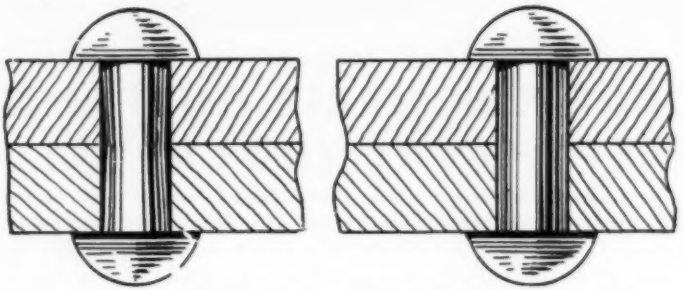

Figure 6—The difference between hot and cold riveting. At left, contraction of hot rivet from the hole surfaces upon cooling At right, a rivet headed over cold in a press fills the hole evenly, so that the heads of the rivets do not take most of the load

Ball bearings should be inspected for defective balls. This is done by holding the inner race in a fixed position and spinning the outer race. If it does not run smoothly, replace the bearings. If it does run smoothly, test it for worn ball races by placing the bearings on a flat surface (such as a surface plate), holding the outer race in a fixed position and trying the inner race

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¶ On page 35 is a form, ready to be filled out. Maintenance men are urged to cooperate in joining this new form of "club."

¶ In order to become a "member" it is simply necessary to participate in these questions and answers, only when you choose to do so, of course. There is *no* fee, *no* dues, and no limitations.

¶ We would like to see every reader join. See pages 34-35.

The Editor

K-D TOOLS *for Speed!*

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SPEED and simplicity are the tricks of the trade which lift your profits. Here's a K-D Valve Spring Lifter that will do the trick. The new No. 380 Lifter has automatic over-center lock and adjustable plunger bar—can be operated with one hand in servicing the modern "low port" motors.

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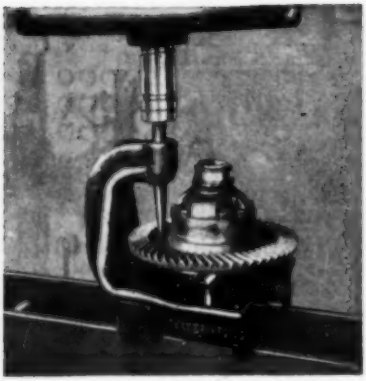

Fig. 7—Riveting the new gear in place by means of the riveting fixture. Under heavy pressure this causes the rivets to expand, equally filling the holes and drawing the gear tightly in place

for side movement. Reject the bearing if there is any side movement.

If the bearing runs smoothly and has no side movement it is in good condition and fit for further use.

The differential side gears, pinion gears, and the cross (or spider) which forms the bearing for the pinion gears should be inspected. The differential side gear end play should not be over .008 in. when assembled in the case. Also, the pinion or spider gears should not have over .010 in. end play when assembled with the other gears.

At this point it is well to check the pinion shaft bearings. If they are worn beyond the point of usefulness they should be replaced.

Ball bearings should be checked as described above. Roller bearings should be checked for pitted rollers or races.

Try the shaft for end play. This is very important because the pinion shaft bearings must transmit the engine torque and withstand the strains of braking. Modern engine speeds and acceleration rates have increased these loads.

It must be remembered that under an increase in engine torque (turning effort) the radial lift or deflection of the pinion increases. With poor bearings this deflection is as much as .005 in. at 75 per cent engine torque. Good bearings, rigidly mounted, reduce this deflection to not more than .0015 in.

If there is any play at all in the bearings of either the pinion shaft or differential case, the best plan is to replace the bearings with new ones. Otherwise the installation of the new gears will not be satisfactory because adjustment, quietness and continued service of the gears naturally depend largely on the ability of the bearings to support them properly. Worn bearings will not

(*Please turn to page 64*)

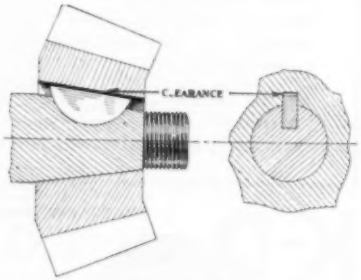

Fig. 8—When mounting a bored-type pinion on the shaft, there must be a little clearance between the top of the key and the keyway in the pinion. Otherwise the latter will ride the key and may cause pinion breakage when pulled up tight

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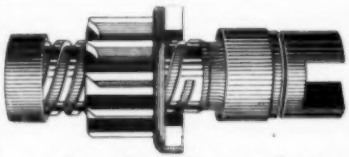

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A Few of the Many Answers to Question No. 11

"We change crankcase oil every 800 miles, but would lengthen this period if we were sure that the oil was fit for further use as a lubricant. New oil is purchased by an analysis of the test samples submitted. Differences in oil consumption, engine temperatures, etc., usually depend on the age and condition of the vehicle. We are interested in knowing further about testing oil in the crankcase while the engine is running."—*Michael Lyons, Deputy Chief Inspector, Police Department, New York City, operating a fleet of 118 trucks, 673 passenger cars and 329 motorcycles.*

"In summer we change oil every 2,000 miles and in winter every 1,000 miles. We purchase oil by trying out different grades. Differences in oil consumption and body can be blamed on condition of motor and habits of the driver. We are interested in knowing more about testing oil while the engine is running."—*H. Weiner, Supt. Motor Trans., Whiting Milk Co., Charlestown, Mass., operating a fleet of 240 trucks and 90 passenger cars.*

"We change crankcase oil every 2,000 miles and oftener if it appears to be diluted, or exceptionally dirty. We determine the type of oil that is most suitable from our experience in actual use. Piston rings, bearings and general condition of motors are responsible for differences in oil consumption, operating temperatures, etc. Please send us the book that gives a practical solution to the problem of testing crankcase oil while the engine is running."—*Bill Wilson, General Foreman, C. S. S. & S. B. R. R. Co., of Michigan, Michigan City, Ind, operating a fleet of 25 trucks, 5 passenger cars and 14 buses.*

"Lubricating oil is drained from our engines monthly, regardless of mileage, although this usually ranges between 800 and 1,000. We buy a good grade of oil by trade name—heavy for summer and light for winter. Since no two motors are alike, engine temperatures and oil consumption will vary. Yes, I would like to have more information about testing oils while the engine is running."—*A. P. Williamson, Manager, Maplehurst Dairy Co., Springdale, Conn., operating a fleet of 28 trucks and 1 passenger car.*

"On over-the-road trucks oil is changed every 500 miles. On others, we change it every 30 days in summer and every two weeks in winter. Oil is changed sooner under exceptional conditions of operation. We would lengthen the period between oil changes if we were sure of the lubricating quality of the oil. Differences in engine temperatures, consumption, etc., might be blamed on the blending of the oil. Would like to get further details on testing engine oil without removing it from the crankcase."—*J. P. Burnette, Supt., Railway Express Agency, Cleveland, Ohio, operating a fleet of 80 trucks and 11 passenger cars.*

Question No. 12 is Important — Please Cooperate!

(Please tear out and mail to Editor, The Fleet Owner, 90 West St., New York)

Question-of-the-Month Club

No. 12—Engine Overhauls

On new vehicles, when are piston rings replaced for the first time? (How many miles? .....) or (Time Period? .....)

What are the symptoms calling for early ring replacement?.....

.....

At what mileage is it necessary to recondition cylinders? .....

What method is used for reconditioning, and what machine? (Check below) Regrinding? ..... Reboring? ..... Honing? .....

Do you sometimes cure oil pumpers and piston slap by the installation of piston rings without reconditioning the cylinders? .....

What make or type of ring is used for this purpose? .....

How often do you perform complete, major engine overhauls? .....

About how many sets of rings are used, per motor, before it becomes necessary to recondition cylinders and fit new pistons? .....

What make or type of ring has been most satisfactory for general replacement when the engine is not in bad condition? .....

When cylinders are reconditioned and new pistons fitted, what make or type of piston ring gives best results? .....

Are pistons, rings and pins purchased from your jobber? .....

Special Remarks .....

.....

Those answering this questionnaire are entitled to free piston ring size and instruction books. Shall we send you free copies? .....

We operate.....Trucks.....Busses.....Passenger Cars

Name of Firm .....

Address .....

City and State .....

Your Name .....Position.....

(Please tear out and mail to Editor, The Fleet Owner, 90 West St., New York)

Advertising *on Your* Trucks

Church Plan, Cooperating With Motor Truck Associations, Offers Ad-Income to Operators

THE value of advertising on the sides of motor trucks has been demonstrated in the past and recent past, and a new plan is now offered whereby all truck operators, large and small, through their local truck associations, can derive some revenue from this type of service. Briefly, the plan is as follows:

The Allen W. Church Company, advertising agency of Grand Rapids, Mich., offers truck operators through their State Associations, an opportunity to substantially increase their incomes without limiting or interfering with present operations. According to Mr. Church, a very complete and systematic plan has been worked out. The Church plan, it is claimed, has been approved by The Motor Truck Executives of America at their recent meeting in St. Louis on June 8th and 9th.

In leasing advertising space on trucks, panel and rack type of bodies can be used and this includes trailers and horse-drawn vehicles as well. The signs are made to fit the trucks and are made up in three sizes—only one sign to be installed on the side of a truck and not more than two signs per truck. The signs can be so placed that no interference with trucking operations will occur; also so that the truck operator can carry his own advertising as well, and thus not lose his individuality.

It would seem that the truck operators have everything to gain and nothing to lose by this plan, as the Church organization intends to build the signs, install them, post the advertising and care for all detail work. The signs and posters can be put on the trucks at such times when they are not operating. Of course, the truck operator participates in the income on a sub-

stantial basis and will share in increases in advertising rates and other revenue that may be derived.

Those operators interested in this advertising plan can get the full details by corresponding directly with their local truck association or from the Editor.

Cutting Truck Operating Costs

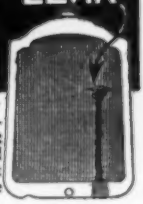
MATERIAL reductions in truck operating costs can be effected through training of drivers in courtesy and safety, H. R. Cobleigh, of the Motor Truck Department of the National Automobile Chamber of Commerce, declared at the annual convention of the New England Coal Dealers Association in Swampscott, Massachusetts, recently.

Lower overhead and insurance premiums and greater customer and public good-will were mentioned by Mr. Cobleigh as the "dividends" which a fleet operator might expect to derive from the safer and more courteous operation of his vehicles.

He also advocated that truck owners provide some incentive in the form of a bonus plan to win the cooperation of their employees. Mr. Cobleigh also spoke on the same subject at a meeting of the Springfield Motor Transport Council.

"Oil is changed depending upon the number of gallons of gasoline used. The viscosity, we find, depends on the amount of gasoline used. We recently lengthened our oil mileage periods and would like to know further how to test crankcase oil before it is drained from the motors. Please also send us all information on reclaiming oil." *W. C. Vogel, President Vogel Cartage Company, Columbus, Ohio, operating a fleet of 11 trucks and 2 passenger cars.*

STOP THAT LEAK WITH SMOOTH-ON No. 1



YOU can apply Smooth-On with radiator full or empty, hot or cold, without removal from the car and without putting anything inside that clogs the circulation.

Merely roll the Smooth-On into a stiff putty, press it against and into the leak with your thumb or pack it into the defect with a knife blade or screw-driver, and scrape off the excess. The leak will stop instantly and the repair is permanent.

Cracked Water Jackets

Water jackets of automobiles, stationary or marine gas engines which have developed long or short cracks or have even had pieces broken entirely out from freezing can be made thoroughly and lastingly serviceable by similar repair, or by applying Smooth-On under straps or a plate.

Get Smooth-On No. 1 in 7 oz.; 1-lb. or 5-lb. tins at any hardware store or if necessary direct from us.

Write for FREE BOOK

Free Booklet

tells how to stop gas leaks from the tank, gasoline lines and exhaust system, oil leaks at gaskets and at cracks in crank or gear case. It also tells how to make headlight posts, nuts, hub caps and belts and grease cups stay tight, etc.

Mail coupon for a copy.

Do it with SMOOTH-ON

SMOOTH-ON MFG. CO., Dept. 71,
574 Communipaw Ave., Jersey City, N. J.
Please send the free Smooth-On Repair Book.

Name .....

Address .....

7-31 .....

Fleet Owners Practice Safety

THE popular belief that truck drivers are a menace to the lives and safety of other highway users is disputed by facts developed in a survey being conducted by the National Automobile Chamber of Commerce.

A tabulation of answers to a questionnaire circulated by the Chamber among the operators of motor truck fleets indicates that fully 94 percent of the truck owners insist upon careful driving by their employees.

More than one thousand fleet operators in charge of an aggregate of 33,881 trucks have already replied to the Chamber's inquiry.

Of these, 44 percent, or nearly half, have a definite program of driver training whereby they impress their employees continuously with the necessity for careful and courteous driving. The 44 percent controls the operation of 74 percent of the trucks figuring in the survey.

Ninety-four percent of the companies which reported related that some effort was being made to encourage better performance on the part of their employees.

Rigid examinations must be passed satisfactorily before an applicant will be employed by 66 percent of the truck owners and a course of instruction for new drivers is maintained by 67 percent of the fleets.

Additional encouragement for good drivers is offered by 46 percent of the companies in the form of salary increases, bonuses or other means, while 81 percent of the fleet owners controlling 93 percent of the vehicles penalize carelessness or recklessness by suspension or dismissal.

More than 40 percent of the operators regularly emphasize safety principles by displaying placards or distributing literature.

Questioned as to the accident records of their fleets, 575 companies had records available for the first six months of 1930 covering an aggregate mileage exceeding 131,550,000 miles and an average of one accident to every 15,945 miles of operation.

Of 448 fleet operators who reported having driver training systems, 224 asserted that their systems had reduced accident; 363 added that they had reduced operating costs and 352 attributed increased business to the good will created by their operators.

Safety Glass Required

NEW regulations governing the construction and use of motor vehicles in Great Britain, recently put in force by the Ministry of Transport, require that beginning January 1, 1932, all new vehicles must have safety glass equipment. Cars now in use are exempt until January 1, 1937. The new regulations say:

"All glass fitted to windshields or windows facing to the front on the outside of any vehicle (except glass on the upper deck of a double-deck vehicle) shall be of the safety type, or so constructed that it shall not fly into fragments."

In the United States, although there are regulations in some localities requiring its use in taxicabs, busses and other public vehicles, the increased use of safety glass has been due to the initiative of the car manufacturers.

More Dead-Weight Reduced

New Gasoline Truck-Tank-Trailer Unit Weighs Less Than One Pound Per Gallon of Payload

WITH the coming of uninterrupted miles of hard-surfaced highways, the opportunity of transporting large quantities of gasoline by motor truck tank, presented itself to the oil industry. But, with the good roads, came also weight restrictions that for a time threatened the economy of highway transportation of oil and oil products.

Load limits were definitely established by laws in most states, and transportation engineers were called upon to solve a most difficult problem, the reduction of dead-weight in truck tank units. For every pound of deadweight eliminated by sound engineering and skillful design, a pound of gasoline could be substituted.

Not so long ago, tankweight per gallon of payload was running from 2½ to 3½ pounds. The most capable engineers in the transportation field attacked the problem. Strength and sturdiness could not be sacrificed. The safety factor must remain constant.

How far engineers have gone toward a solution of the problem can be realized by the fact that an all-aluminum truck tank unit weighing less than a pound per gallon of payload, recently was delivered to the Humble Oil Company by the Standard Steel Works of Kansas City, Mo.

This truck tank and trailer unit, comprising a train with a capacity of 6,493 gallons, now is in daily service by Humble. Every useless pound of metal was stripped from it by the engineers and designers. It is one of a dozen or more all-aluminum units delivered in the last year by the Standard Steel Works, which company strongly advocates the use of aluminum for truck tanks.

By skillful designing and engineering, and the use of high strength steel this same company has also produced several all-steel units with a deadweight of 1¼ pounds per gallon of payload, a reduction of almost 50 per cent, over previous figures.

"We are putting metal where it is needed," said O. N. Gredell, chief engineer for the company. "We are making every pound in every unit pay its way."

Keeping Them Clean

Paint and Lacquer Expert Gives Practical Hints on Washing and Polishing Commercial Cars

By G. W. Sherin*

OWNERS of business and commercial cars naturally have two very special and practical reasons for keeping them bright and new looking. The dollars-and-cents reason that a well kept car means longer service is one. The advertising value of a good looking car is the other.

Washing is, of course, important. But washing is not enough, for even soap and water will not remove "traffic film"—that dirty coating of oily, sticky particles of dirt which accumulates on the finish.

Traffic film is easily removed, however, with an application of a good neutral polish that cleans and polishes with one operation. This double-quick action saves time and that is important. Just apply the polish with a small clean cloth folded into a pad and rub vigorously a few minutes to thoroughly loosen all chalked pigment and dirt film. Allow the polish to dry, then wipe it off and polish with a clean dry cloth. Neutral polishes are particularly recommended for lacquer finished cars. They are not inclined to collect dust like an oil polish and contain no acids or harmful abrasives.

Cars polished this way do not have to be washed so often either. A good neutral polish produces a dry, hard, brilliant lustre which can be brightened up daily for a long time (unless muddy) by simply wiping off the dust with a clean soft cloth. This is important, of course, b cause it saves both time and money.

Auto and truck tops are also particularly important to owners of business and commercial cars because they are usually exposed to the weather much more than private automobiles. This inclines them to check, crack, leak and rot if not protected with a good grade of top finish. Just a few minutes are required to dress an automobile top and a good top dressing both renews and waterproofs the material. The top should be dressed whenever the lustre dies or checking starts.

For re-touching scratches, worn and rust spots on auto fenders and other parts of the car finished in black, use a good quality of touch-up black. It will dry jet black with a high lustre that does not need polishing. Touch-up black can be obtained in handy size cans with a handy brush attached to the cap. A few moments now and then for touching up will go a long way to prevent shabby looking cars.

It pays to advertise, of course, and a good looking business car is a good ad. And as also stated, a well kept car *does* mean longer service.

* *DuPont Company, Wilmington, Del.*

Governors *Cut* Costs

Chicago Manufacturer Offers Key-Controlled Governor that is said to be Cheat-Proof

UNDUE wear-and-tear and depreciation on a truck, in nine out of ten cases, is due to excessive speed of operation and overloading. Trucks, as built today, are sturdy units of transportation, capable of bearing their rated loads, and sometimes more. But no truck can stand the abuse of hard, fast driving, of excessive braking, of constant strain on clutch and transmission and unreasonable demands on the motor under heavy loads without showing some ill effects.

It seems reasonable, therefore, that some check should be held on the truck driver and that the speed at which his truck can travel be held to some pre-determined mileage.

Records of truck fleets that are governor-controlled show that a truck equipped with a governor will invariably show as high as 50 per cent greater tire mileage and 50 per cent longer brake lining life than on trucks that are not so equipped.

No one will doubt that a truck on the job is worth two laid up for repairs—and those fleet owners and maintenance supervisors who are closely watching maintenance costs, undoubtedly are unanimous in insisting that each of their units be equipped with a suitable governor.

An investment in governors is one of the wisest that a fleet operator may make—not only from the standpoint of lowered maintenance costs, but from the greatly decreased accident hazards, which, left to run wild, would result in costly damage suits.

In this connection it might be pointed out that one of the pioneer manufacturers of governors for controlling the speed of automotive vehicles, the Klemm Automotive Products Company, 1302 N. Halstead St., Chicago, Ill., is now offering a governor that is said to be "fool-proof."

Klemm governors have been used by some of America's most prominent firms operating large fleets and the new governor, illustrated here, gives the owner or superintendent positive control, at all times, of the speed at which he wants his vehicles driven.

One of the exclusive features of the new "cheat-proof" governor is the key control, making it impossible for the driver of the vehicle to alter

Klemm "Cheat-proof" Governor.

the speed at which the governor is set. Models are available to fit all motors. Inasmuch as governors prolong the life of both motor and chassis, as well as save tires and brake linings, every fleet operator should be interested.

The device is offered on a 30-day free trial, and is sold by leading automotive jobbers; or you can write to the manufacturer mentioned above.

Lempco Products, Inc., Expands

AT their last meeting the Board of Directors of Lempco Products, Inc., Bedford, Ohio, one of the world's largest manufacturers of replacement brake drums, axle shafts and worms and gears, authorized a plant extension involving a $250,000 expenditure.

This big addition to the already large Lemco plant is necessary, reports the company, to take care of the phenomenal and constantly increasing demand for Lempco replacement parts. This company reports 1930 was the biggest year in their history and this year's sales are running far ahead of the first five months of last year.

Lempco Products, Inc., expected to have this new $250,000 addition to their plant in full operation in 90 days. When completed, it will employ 75 to 100 additional men. It is interesting and gratifying to note that this large replacement brake drum and axle manufacturer has not found it necessary to reduce wages. Everyone of their employees, they report, is enjoying the same high wage scale as was in operation in 1929; in fact, a great many of this company's workers have had wages increased during the past eighteen months.

Little Giant Acquires Lee

ANNOUNCEMENT has just been made to the effect that the Lee Trailer & Body Company, Plymouth, Ind., has been absorbed by Little Giant Products, Inc., of Peoria, Ill.

The building of bodies and trailers will be continued at Plymouth, but the plant operation will be directed from Peoria. There will be no change in the personnel, but there will be additions in all departments, according to Walter J. Becker, vice-president and secretary.

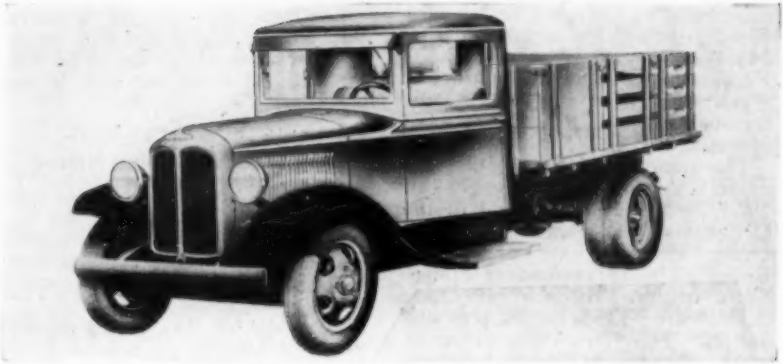
Raybestos Brake Testers

ARRANGEMENTS have been made for the manufacture of Raybestos type brake testers by a subsidiary of Bendix Aviation Corp. The Raybestos Division will continue the distribution of this machine, which will also be distributed by Bendix-Cowdrey, Inc. The Raybestos Division will likewise act as one of the distributors of Bendix-Cowdrey brake testers, according to recent announcement.

S.A.E. Transportation Meeting

AT Washington, D. C., November 10th, 11th and 12th, the National Transportation Meeting of the Society of Automotive Engineers will be held. This meeting will be the annual gathering of engineers, executives and other officials of motor vehicle fleet operating companies throughout the country.

At the meeting the usual reading and discussion of technical and economic subjects relating to their organization, equipment and operation will take place. Normally, the attendance at this meeting is about four hundred.



New Speed Wagons *by* Reo

One-and-One-Half Tonners Are Powered by Four and Six Cylinder Engines—In Two Wheelbases

NEW four-cylinder and six-cylinder Speed Wagons are now offered by the Reo Motor Car Company, Lansing, Mich., in the lowest priced field. Both have typical Reo characteristics that have heretofore been associated with the higher priced field. The four-cylinder chassis is priced at $625 and the six-cylinder lists at $725. Both are one-and-one-half tonners.

Both the four and the six are furnished in 136-inch wheelbase with 160-inch available at slightly higher prices. Both engines are of typical truck design, the four having a crankshaft 3" in diameter supported by five bearings, while that of the six has seven bearings. Both have full pressure lubrication to all moving parts including wrist pins, the latter by means of rifle-drilled connecting rods. Cylinder blocks are of chrome-nickel alloy iron.

Power is transmitted through a 10-inch single-plate, dry clutch and a four-speed transmission, both designed for truck service. Connecting to the full-floating rear axle is a large two-joint propeller shaft of the tubular type. On the long wheelbase models the shaft is of the two-piece type with three metal universal joints and a self-aligning central support.

The spiral bevel drive pinion is straddle-mounted between a large double-row ball bearing and a single-row pilot bearing. Two tapered roller bearings support the differential and two are used in each rear hub. Front hubs are likewise fitted between the spindles and the axle center. The spindle thrust bearings, the steering lay-out and the cam-and-lever steering gear all contribute to easy steering.

Fully enclosed, four-wheel, inter-

nal-expanding hydraulic brakes with 15 x 2¼-inch shoes in the rear and 14 x 1¾-inch in front are fitted. Parking brake is of the contracting type, mounted at the back of the transmission with a two-inch band operating on an eight-inch drum.

The standard 136-inch wheelbase model has a frame length of 102-1/16 inches behind the cab and a distance from back of cab to center of rear axle of 60-1/16 inches. The corresponding dimensions of the 160-inch wheelbase model are 126-1/16 inches and 84-1/16. The frames are 34 inches wide, of straight channel section with 7 inch maximum depth and 2¾ inch constant flange width. Frame stock is 5/32 inch for the standard and 3/16 for the longer wheelbase. Frames are reinforced by five cross-members, the front being spring steel attached directly to the frame horns. Front springs are made 40 x 2-inches and rears 50 x 2½-inches.

The new bodies are offered in many varieties and with many special features as will fit them to almost every conceivable hauling need for which ton-and-a-half trucks are used. The radiators are of a modified Vee design and the lines of the fenders and hood flow smoothly backward to the cab and the running boards. Cabs are built to provide comfort.

It is important, Reo engineers believe, that the driver of a commercial vehicle be protected to the utmost against fatigue. A driver who does not become tired long before the end of his day's work and whose pleasant disposition does not suffer as the result of weariness resulting from discomfort, they believe, is an asset to any business that no far sighted management can afford to overlook.

Catalogs and descriptive literature will be cheerfully sent on request without obligation. The Editor will get them for you, if you prefer.

Reo Branch Manager Named

C. R. ARENSCHIELD has been appointed manager of the Reo Sales Corporation of Philadelphia, according to recent announcement made by Elijah G. Poxson, general sales manager of Reo.

Mr. Arenschield returns to Reo after an absence of several years. He was, for a period of years, associated with Studebaker as manager of various banches, and leaves behind an enviable record of sales with that company. J. W. Culverhouse has been appointed assistant manager.

Panyard Ring Sales Increase

STIMULATING reports have been received from the Panyard Piston Ring Company, Muskegon, Mich., telling of remarkable increases in their piston ring sales.

Since the first of this year the Company has more than doubled its sales each month, and has found it necessary to run overtime shifts in order to keep up with the tremendous increase in orders. New high-speed machinery has recently been installed to enable them to keep up production, the report further points out.

The increase in sales is attributed to the 1931 model Panyard ring and the Panyard oil ring, and their widespread acceptance by fleet owners, garage men and automobile dealers, according to the company. Panyard catalogs are free for the asking.

Heavy *Ones by* G. M. T.

Two New Heavy-Duty Models in the 4 to 5½-Ton Range Have Typical G.M.T. Characteristics

TWO new heavy duty models in the four to five-and-one-half ton range, alike except in rear axle design, have been added to the General Motors Truck Company line, it was announced at the factory recently.

Both rear axles are full floating. In Model T-51 at $2,565 it is spiral-bevel gear type; and in Model T-55 at $2,690 it is double-reduction type. Prices are for base chassis f.o.b. Pontiac.

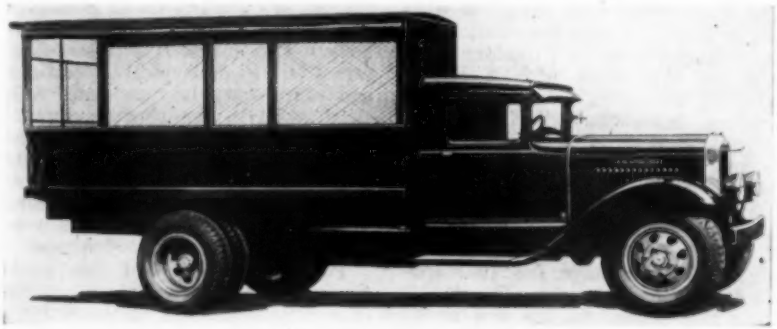
Primary reduction in the rear axle of Model T-55 is through spiral-bevel gears; secondary reduction through herringbone gears. All gears are mounted on anti-friction bearings. In both models, axle shafts are of chrome molybdenum steel two inches in diameter. Housings are malleable iron.

Both models are powered by the General Motors Truck 6-cylinder, 94-horse-power engine. This is the engine adopted for heavy duty four years ago by General Motors Truck Company.

Frames of the T-51 and T-55 are 9 inches deep, pressed from steel 9/32-inch thick. Flanges are 3½ inches wide and there are 5 or 6 strong cross members, depending on wheelbase length. The exclusive GMT stress absorber is an added feature of the frames.

Springs match other parts in their ability to provide proper riding qualities under all load conditions. Rear springs are 50 inches long with 11 leaves and have auxiliary springs 35 inches long with seven leaves. Front springs are 40 inches long with 12 leaves.

Both models have 4-speed transmissions of the sliding-gear type with all gears of pack-hardened, 5



Model T-51B with standard cab and canopy top screen body.

percent nickel steel. The clutch is simple, durable double disc type, mounted in fly-wheel housing on ball bearings. Driving discs are of heavy cast iron for dissipating heat. Four-wheel brakes and roller bearing, worm type steering gears provide safe, easy handling. Further details sent free on request.

Continuous Base Rims

TO meet the present-day requirements of the balloon tire and heavy duty service, Firestone Steel Products Company, Akron, Ohio, recently introduced the type "R" rim, which, like other types of Firestone rims for dual mounting, is of the continuous base construction and made in one piece. The locking ring, which is riveted to a continuous side ring, is easily removed and always visible.

This new rim has many entirely new features, yet it is interchangeable on the same wheels with other types, since the standardized 28-degree mounting bevel has not been altered. It has been adopted by many truck and bus manufacturers as standard equipment.

The Firestone Company points out that trucks now equipped with solid tires or single pneumatics can be changed over to Firestone continuous base rims with a standardized 28-degree bevel, by either cutting down the wheel and applying Firestone Universal D-6 bands, or by using new disc or cast wheels. All rims of this new type operate the same, either on a disc or cast type of wheel.

All Firestone rims designed for dual mounting have the standardized 28-degree mounting bevel.

In this connection the new booklet "Changeovers Made Easy" just issued by The Firestone Steel Products Co., Akron, Ohio, will be found of great interest. For your free copy of this helpful little book, write to the Company. If you prefer, the Editor will be glad to see that you get a free copy. Just drop us a line.

New Manual of Body and Fender Repair Work

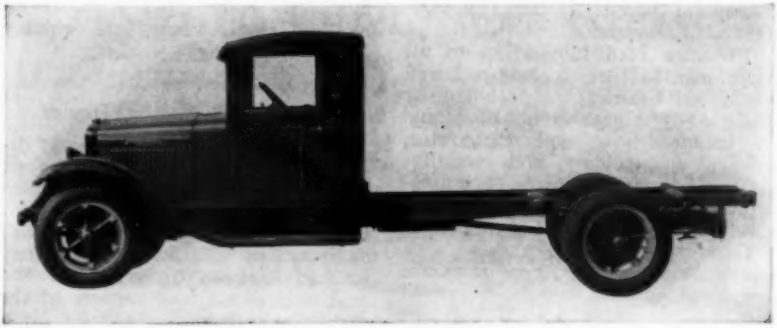
BODY and fender repairing may be compared to lubrication, washing, etc. in the frequency of its performance. With the rapid increase in passenger car, bus and truck registrations has come a corresponding increase in the number of accidents and collisions—both of which mean more body and fender repair jobs.

As a useful guide in taking out many of the "bugs" in automobile body and fender repair work, the Stanley Rule & Level Plant of New Britain, Conn., offers a new 48-page manual.

This new manual is a most useful instruction book which describes in detail the correct-set-up for body and fender repair work and the actual operations required for repairing all types of crumpled and dented parts of an automobile body. The manual is well illustrated to show typical operations and short-cuts to produce first class work in the shortest time.

The Stanley Manual is one of the most complete manuals on body and fender repair work ever compiled. The information on each separate operation has been supplied by experts in the business.

To secure a copy of this time-saving instruction book, enclose 50c in a letter addressed to the Stanley Rule & Level Plant, New Britain, Conn.



New International Trucks

Models A-2 and B-2 Are New 1½-Ton Jobs Powered With Four-Cylinder, L-Head Engines

INTERNATIONAL Harvester has recently announced two new 1½-ton trucks, the Models A-2 and B-2. These new models incorporate all the desirable characteristics of preceding Internationals of the same size and type and, in addition, have many performance features that make them superior to their predecessors, according to the manufacturers.

The Model A-2 is built in two wheelbases, 136 and 160 inches. Both wheelbases have a body allowance of 1,200 pounds, and for commercial hauling and delivery service both have a maximum carrying capacity, including body and pay load, of 4,200 pounds. However, for dump truck service a maximum gross carrying capacity of 4,575 pounds, body and pay load, is permitted on the 136-inch wheelbase chassis.

The Model B-2, called the Six-Speed Special, is built only in 136-inch wheelbase. It has a maximum gross carrying capacity, body and pay load, of 4,200 pounds for commercial service and 4,575 pounds for dump truck service.

Both of these trucks employ the same units throughout, with the exception of rear axles and transmissions. In the Model A-2 the rear axle is of the single-speed, spiral-bevel drive type. In the Model B-2 a two-speed axle is used, which, coupled with the three speeds of the transmission, provides six forward and two reverse speeds. In the Model A-2 a four-speed transmission with one reverse is employed, while the Model B-2 has a three-speed transmission.

Both of these new Internationals are powered by a 4-cylinder, L-head type engine, 3⅝-inch bore by 4½-inch stroke. Piston displacement is 185.8 cubic inches and the engine develops a maximum of 39 brake horse power at 2400 r.p.m. Its

maximum torque is 120.5 pound-feet at 1000 r.p.m.

Pressure feed lubrication to all main, camshaft, connecting rod, and wrist pin bearings is provided by the gear-type, gear-driven oil pump. A balanced-flow type carburetor, efficient manifolding, and specially-designed cylinder head (compression ratio 4.6) offer maximum engine efficiency and fuel economy.

Cast spoke type wheels with single bevel mounted type rims are employed on both models. Standard tire equipment is 5.50-20 balloons front and 6.00-20 balloons rear. Dual rear wheels and tires will be supplied on special order. Oversize tires for both single and dual wheel equipment are also available.

The 136-inch wheelbase chasses have heavy pressed-steel channel side rails, 5⅞ inches deep with 2¾-inch flanges. On the 160-inch wheelbase A-2, the frame depth is 7 inches and the flange width is 2¾ inches.

Spring mountings are interchangeable on the two models, as are the springs. All spring leaves are of alloy steel and both front and rear are of the semi-elliptic type. The front springs are 2 inches wide by 40 inches long with eight leaves. The rear springs are 2½ inches by 46 inches with twelve leaves.

Standard equipment for both models includes cowl and dash; front fenders with short running boards; a sturdy front bumper; an underslung tire carrier and spare rim; complete electric equipment, including starter and depressed twin-beam headlights; air cleaner; jack; and tools.

A convertible, roomy, two-man cab, designed and built by International Harvester, as well as numerous body types to meet all hauling requirements, are quickly available for these models.

Direction Signaling Device

A NEW set of day and night direction signal lamps with red light arrow indicators has been perfected by the Pines Winterfront Company of Chicago. These will be known as "Directo" sets and may be had in twos or fours for the rear only or all four corners of the car. Each signal light rests on a bracket that is placed on the same bolt which holds the bumper to the car. The end on which the light is fastened is a semi-universal joint that permits the light to be placed at any desired angle. All lights are controlled from a trip lever attached to the steering wheel. The regular battery furnishes ample power for the set.

When the driver desires to turn to the left he trips a Y shaped lever and the two left lights show left direction arrows which remain lighted, either day or night, until the steering wheel turns the automobile wheels back to straight ahead position and this motion automatically shuts off the light switch. The right turn is made in exactly the reverse manner. The Y trip lever is in a convenient position for the hands and can be actuated by merely touching it with a finger.

Each light is a horizontal oval and contains a very large bulb beneath the red glass arrow that is in relief and held in position by means of a flat nickeled plate which fits snugly around the portion of glass in relief and also acts as an efficient retainer, as well as protection against possible breakage.

White *Offers Two* Sixes

Models 601 and 602, Recently Announced, Were Designed Particularly for Retail Delivery

WITH the introduction of Models 601 and 602, The White Company, Cleveland, Ohio, adds to its line two six-cylinder models that are especially suitable for use in the retail delivery field. The six-cylinder engine used in both of these chasses is of the L-head type and has a bore and stroke of 3½ by 4½ inches, giving a piston displacement of 260 cubic inches, with an N.A.C.C. h.p. rating of 29.5.

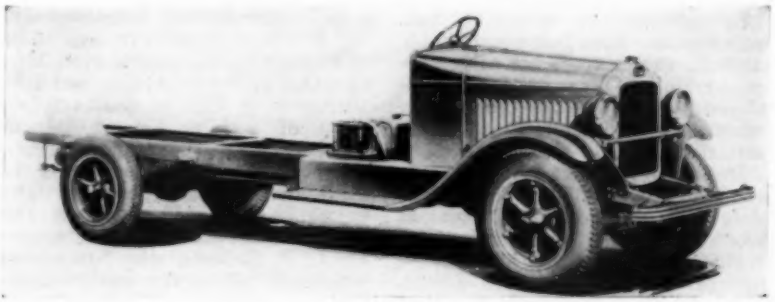
Other engine features include battery ignition system, Zenith carburetor, full pressure lubrication, rifle-drilled connecting rods for lubricating the piston pins, silent-chain front drive, electric starter and generator, roller-bearing-mounted fan, detachable cylinder head, aluminum lower crankcase and special inverted oil reservoir.

The single-plate clutch operates in oil and is equipped with a ball-bearing throwout. Adjustment is effected by screwing in a threaded plate under the clutch cover. Transmission is of the four-speed type, mounted in a unit with the engine, with positive locking for the shifter bars.

Front axle is of the reverse-Elliott type, with tapered roller bearings used on the wheel spindles. The rear axle is of the spiral-bevel, single reduction, semi-floating type, with one-piece cast housing, mounted on tapered roller bearings throughout, including the wheels.

Service brakes are of the internal-expanding, four-wheel, Lockheed hydraulic type, operating in gun-iron brake drums which are interchangeable, front and rear, having dimensions of 16¼ by 2¼ inches. Parking brake is mounted at the rear of the transmission; it is of the external-contracting band type.

Springs are of the semi-elliptic type, the rear ones being designed for the Hotchkiss drive. Steering



gear is of the nut-and-lever type. U-section spoke cast steel wheels for 20-inch base rims with 7.50/20 balloon tires are used on the Model 601, single front and rear; on the Model 602 dual rear tires are used with dimensions of 7.00/20. Other balloon and high pressure tires are optional at extra cost. Gross weight ratings are 9,000 lbs. for the Model 601 and 10,000 lbs. for the Model 602. Other details on request.

New B-N-Dall Representative

B. H. MOORE, has recently been appointed sales representative for Dall Motor Parts Co., and Burgess-Norton Mfg. Co. in the territory served by their Chicago warehouse, which includes the states of Illinois, part of Indiana, Iowa, Wisconsin and Minnesota. Mr. Moore succeeds Paul V. Spain, recently resigned.

Experienced Maintenance and Delivery Supervisor Available

A PRACTICAL maintenance man, with over fifteen years' experience in operation and maintenance of motor trucks and buses now seeks a connection with transportation or vocational fleet.

In addition to practical fleet maintenance, have had considerable machine shop experience and technical training. Was previously employed by one one firm for twelve years as Superintendent of Transportation.

Desire to connect with concern in vicinity of New York City. Complete details as to ability, previous accomplishments and references available on request or interview.—Address communications to Editor, THE FLEET OWNER, 90 West Street, New York City. All replies will be held in strict confidence.

Piston Shop Equipment

SHOP equipment for finishing pistons is interestingly described and priced in a new Catalog No. E. 30, recently issued by the Dall Motor Parts Company, Station D., Cleveland, Ohio. Such items as piston grinders, power reamers, chamfering machines, etc. are included. Write to the Company, or the Editor, for your free copy of this interesting catalog.

"Doc" Procter Heads Parkin

R. W. PROCTER, for twelve years sales manager for Black & Decker, and later for Van Dorn, is now identified with Parkin, Inc., spark plug manufacturers, of Cleveland, Ohio. Mr. Procter is president and will merchandise his plugs in the automotive trade under a protected territory plan of distribution. Three models of this plug are said to meet nearly all gasoline engine requirements.

B-N-Dall Export Department

ANNOUNCEMENT has been made by Burgess-Norton Mfg. Co., Dall Motor Parts Co., and Wilkening Mfg. Co., of the establishment of a joint Export Department to handle the sales of their lines in all markets outside of the U. S. and Canada. The Export Department is located at 2000 S. 71st St., Philadelphia and is in charge of A. P. Roberts, who has visited practically all of the world's automotive markets.

The Trouble Shooter

A DEPARTMENT devoted to correspondence from readers of THE FLEET OWNER. Any questions having to do with fleet maintenance will be answered. All properly signed inquiries will be replied to by mail and such of them as are believed to be of interest to other readers will be published in these columns.

Address your questions to the Trouble Shooter Editor. We must decline to reply to correspondence not signed with the writer's full name and address.

When to Change the Oil?

Question: We are responsible for the maintenance of a fleet of approximately 1,200 vehicles. The majority of these are passenger cars, Model A Fords and some larger cars such as Packards, Cadillacs and Pierce-Arrows. We have made it a hard and fast rule to change crankcase oil on these vehicles at intervals of 800 miles and have religiously lived up to it.

Our purchasing department has had several samples of this used oil analyzed and they report that we are changing oil prematurely in many cases, since some of the analyses show that crankcase drainings are still fit for further use—in some cases as high as five or six hundred miles more.

The question now is, when should the oil be changed? We do not want to use the oil too long so that the motors will be damaged by faulty lubrication, but on the other hand, we want to satisfy ourselves, and our purchasing department, that we are not wasting oil by changing it before it has outlived its usefulness. What would you suggest as a happy medium, or a "yardstick" to go by in the future?—A Reader, New York City.

Answer: This is a very, very difficult question to answer. In fact, it is impossible to supply you with any definite mileage figure that would fit into all phases of operation and that would apply to all the vehicles in your fleet. We believe your 800-mile figure to be conservative, to say the least.

Let us first see what the various engine and car manufacturers have to say on the subject. Since you mention Ford, the instruction book on this car says that draining should be done "every 500 miles." Another manufacturer says that "once a year" is sufficient, provided that good oil is used and the level is kept up by constant replenishing. Other manufacturers give figures of 1,000 miles, 2,500 miles, etc., but all of them say that it depends on the type of operation and the season of the year. You are correct that there is a universal demand for a "yardstick" by which the average

operator can judge.

This question is very much like asking "How often should we have our suits cleaned; how much food should a man eat; or how often should we have our shoes repaired?" Since crankcase oil does not wear out, but simply becomes contaminated with foreign impurities and these contaminations depend entirely upon the operation, no answer that we can give you would apply to all makes of cars and trucks under all operating conditions.

It goes without saying that the installation of a good oil filter on each car will permit you to use the oil for longer periods between drainings. Air cleaners assist in a similar manner. On the other hand, if used oil is not thrown away, but is reclaimed for further use, it might even pay you to change your oil on the 500-mile basis and thus get maximum efficiency and economy.

The whole problem that is before you seems to emphasize the need for some kind of universal "yardstick" that will enable you to get the maximum service from lubricating oils. As long as the lubricating qualities are good, there is no reason why the oil cannot be used for longer periods, as your laboratory analyses point out. Sticking to a universal mileage period might be satisfactory from one standpoint, and unsatisfactory from all others.

In this connection, we are sending you a booklet, the aim of which it is to give a practical solution to the problem of testing crankcase oil, *without* removing it from the engine, and while the engine is *running*. This should be of some assistance in helping you get good engine performance and satisfy your purchasing department at the same time.

(Editor's Note: We sent this reader a booklet entitled "A Practical Test for Viscosity." Should other readers desire free copies they can be obtained from the office of this publication, without cost or obligation. Just write a line to the Editor and ask for it. We believe it will indicate possible, worthwhile savings in your operating and maintenance expense.)

A Reader Offers a Remedy

"In a recent issue of your publication, one of your subscribers writes that he is having trouble in getting his Model A Ford brakes to stop the car, in spite of any adjustments he might make. Here is my suggestion which perhaps will help him out as it has helped us out:

"Take out all clevis pins at ends of brake rods at the wheels. Back off brake adjustments at the drums. Now set cross-bar or equalizing-bar in center of holes in frame and put a piece of wood on each side of bar (4 pieces) so bar cannot move. Next pull the brake lever at each wheel forward with one hand and turn wheel with other hand until brake starts to drag, and screw clevis up on rod until it meets brake lever. Install clevis pin and repeat on all four wheels, doing the rear ones first. Make the rear brakes a shade tighter than the front. Take out the wood and you will have *brakes.*" —*A. W. S., Philadelphia, Pa.*

(Editor's Note: This remedy is also recommended by the Ford Motor Company, and is usually used when the pull-rods have been tampered with and are misadjusted to different lengths.)

Piston Slap Defined

THE most difficult engine noise to deal with is commonly called piston slap. The cylinder walls must act as a guide for the piston in its up-and-down travel. When this adjustment is disturbed by improper piston fit, wear, or distortion of cylinder walls, some part of the piston strikes with a slap against the cylinder wall.

While the resulting noise is most common in worn motors, it is not infrequently found in new cars. Sometimes it is present at one speed only—the engine running quietly most of the time. And in aggravated cases at high speeds, the piston actually "flutters" in the cylinder.

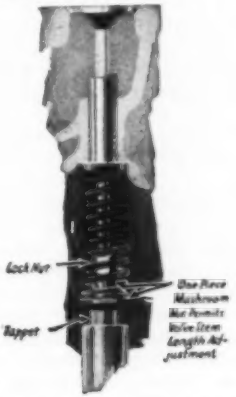
It is important to the fleet owner that piston-slap be corrected as soon as it appears, for it not only causes unpleasant noise, but brings about excessive wear. Its elimination greatly increases the life of the motor and avoids future costly repair bills.—*Suggested by Simplex Piston Ring Company.*

Adjusting Ford Valve Tappets

Question: Can you tell us whether or not there is a concern making metal caps to fit on the bottom of the Ford Model A valve stems so that it will be possible to make an adjustment on this type of valve? If you have any information as to where we can secure these, it will be appreciated.—H. M. S., Hartsdale, N. Y.

Answer: We have made a rather exhaustive search into this matter and have failed to find any concern who makes such a product. We believe it would be rather difficult to get a metal cap onto a Ford valve stem because the stem is flared at the bottom. From our experience with Model A Fords, it has seldom been necessary to use such a thing, as there never seemed to be excessive clearance. In fact we have seen cases where the mechanics had to increase the clearance by grinding some metal off the tappets because the valves were too tight.

In making our search we did run into something that might interest you. This is a replacement valve for the Model A Ford with an adjustable stem.



You will note from the picture that the valve stem is tapped at the end and that a one-piece mushroom nut, with locknut, permits adjusting of the valve stem. We are sending you a complete description of this product under separate cover, so that in the event that you care to make the necessary replacement, you will know all about it.

Should any of our readers be interested in this product, we will be very glad indeed to see that the full details, prices, etc., are sent to you without obligation on your part. Ask the Editor for details on the "Ford adjustable valve."

Gets Hot and Steams

Question: We have a 19-48 Pierce Arrow in use as a wrecker or tow-car which is giving considerable trouble as far as cooling is concerned. We fill up the radiator, start the engine and shortly afterwards a steady stream comes out of the overflow until the system is all but empty. Consequently the water gets very low and heats up and steams.

It doesn't do any good to add water as it only pumps it out again. The thermostat had been out of the car before we got it. The hoses are clean and we have tried washing out the radiator which also seems clear. We tried sort of a baffle plate in the neck of the radiator to check the overflow, but to no advantage. A remedy will be greatly appreciated, and how.—C. B., Fairview, N. J.

Answer: There is little doubt that the cooling system of your wrecker has become partially clogged with rust and the walls coated with scale, particularly the engine water jacket, because your motor is quite old. A thorough cleaning, therefore, will likely cure your trouble. We are sending you an article from our October issue which gives complete instructions for proper cleaning and also a copy of a cooling system manual, which gives further information on this subject.

After the cooling system is thoroughly clean, using plenty of compressed air and water, it would be well to inspect the water pump assembly to make sure that the impeller has not sheared off the shaft, since that might be responsible for some of your trouble.

We believe that the thorough cleaning outlined in the enclosed literature should prove entirely effective, but in case a more strenuous method should prove necessary, we will be very glad to hear from you again, at which time we will outline for you an acid cleaning method, which is sometimes used in cases of extreme clogging.

(Editor's Note: We sent this reader a free "Cooling System Manual." We have just obtained a small quantity of these and will be glad to send them out to interested readers, free of charge; first come, first served. Use your letterhead and ask for the Cooling System Manual; it's free for the asking.)

Lubricating Open Gears

OPERATORS of cranes, excavating and other machinery will find the following home-made mixture an especially efficient lubrication for open gears:

White Lead .....½ lb.
Cylinder Oil .....½ gal.
Flake Graphite .....½ lb.

It will be found that this mixture adheres well to the gears and that it can be painted on with a brush, as required, at intervals of about five hours.

The graphite and oil form the lubricating content of this mixture. The white lead acts as a binder, and keeps the gears from cutting.

Cup grease may be substituted for the cylinder oil. The graphite may be omitted, but it is not advisable to do so in warm weather.

Some of the standard gear compounds may be used with good results, but they have a tendency to run off the gears and get into the machinery, usually resulting in a dirty machine. However most of these compounds may be obtained in grades that are suitable for use

in various temperatures.

The white lead mixture may be made heavier for warm weather by using less oil or grease in proportion to the quantity of flake graphite.

Above all, keep all moving parts properly lubricated for increased life and efficiency.—*Suggested by The Link-Belt Company.*

Knocks and Stops Dead

Question: We have a Whippet 1927 which, when warmed up—and she warms up very quickly—produces a bad knock. The knock sounds as if something inside is loose or broken. When the motor is cold it runs all right, but after going for a distance of about 30 miles it gets very hot, starts to knock, doesn't pull and finally slows and stops dead. The motor is then very stiff and is almost impossible to turn it over.

This motor previously had no compression and new rings were installed. Since installing the rings and grinding valves, the compression has not improved any. What do you think the trouble can be?—H. D. E., Providence, R. I.

Answer: We feel certain that the trouble you are experiencing is due to the improper fitting of the piston rings, which you say were recently installed.

Judging from your letter, we would say that the rings perhaps were installed without proper clearance at the gap; perhaps they were oversized in diameter to a greater extent than was necessary. Insufficient piston ring clearance will produce considerable "ring drag" and will cause the motor to warm up very quickly.

As the rings continue to expand from this heat they will finally reach a point where they will "seize" the cylinder walls and stop the motor dead, as you describe. This overheating and consequent seizing will cause the knock you mention.

Our advice is to tear down this job and make sure that there is about .006 to .008 inches clearance at the ring gap or joint. If you do not care to tear down the motor, we would suggest that you run it very slowly for the first 1,000 miles which might work it in somewhat and produce good compression with a minimum of friction. It might also be advisable to use some good "breaking-in" oil during this period, or a light oil of good quality. We do not believe your trouble is any place else, since the motor runs well when cool.

Testing for Faulty Plug Wires

WHEN a car hasn't good getaway or power on hills, check the plugs and then see that the distributor points are properly set. But don't stop there. The motor may sound o. k. on the floor, but it's how it acts under a "pull" that counts.

If a steep hill is not handy, get someone back of the wheel and tell him to set the brakes, feed the gas and slip the clutch just enough to put a load on the engine and raise the compression. If there are any invisible cracks in the ignition cable, the electricity will find it easier to jump the plug gap under such increased compression.

If the cables are faulty, you can actually hear the "click-click" of the sparks jumping from the cable to the conduit. Without going any further you can be sure that a new set of spark plug wires is the cure. —*Suggested by Packard Electric Company.*

What YOU

New Products of Interest

Parkin Spark Plugs

A SPARK plug with several features has recently been introduced by Parkin, Inc., of 4712 Chester Ave., Cleveland, Ohio. It is an all-purpose plug, according to the makers, adaptable for all types of motors, both high and low compression, and especially recommended for heavy-duty work.

The Parkin plug has an internal chamber that fires simultaneously with the spark and shoots a flame straight down into the combustion chamber, consequently causing all the compressed gas to explode at once, the manufacturer points out.

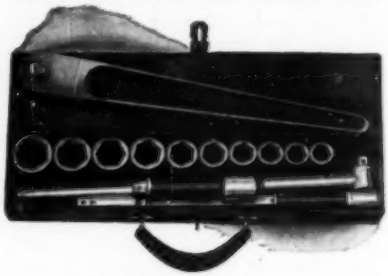
On the nose of the plug are placed a series of fin-like grooves, to retard the heat and keep the plug cool. The points are adjustable and it is claimed will hold a constant gap. It is a plug of the two-piece type assembled with two solid copper gaskets. Made in metric and ⅞ inch sizes.

The fact that but three types of Parkin plugs will service practically all types of automotive engines, according to the makers, should simplify stocking problems. The new plugs will be sold through automotive jobbers.

Heavy Duty Socket Set

EVERY mechanic who considers himself equipped to handle work on drive shafts, axle shafts, steering arm units, tractors, trucks, farm equipment or industrial machinery, needs some sort of heavy-duty socket wrench set. The set illustrated here was designed to fill this need.

This Husky set is regularly supplied with fifteen heavy-duty units,



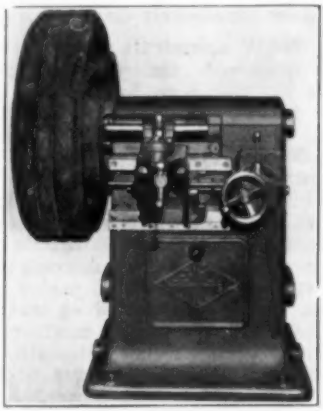
with 13/16-inch hexagon handles and six-point sockets. The ten hexagon sockets range from 15/16 to 1⅝ inches. Balance of the set includes 20-inch ratchet with plug, combination tee, handy grip and swivel-extension.

WANT to KNOW

The set is packed in a strong steel box. List price and complete details will be sent on request. Address: Husky Corporation, Kenosha, Wis. The Handy Husky Wrench Handbook is free. Write for it. If you prefer, the Editor will see that your request is immediately filled.

Lempco Brake-Drum Lathe

WHAT is believed to be the last word in brake-drum reconditioning machinery is offered by Lempco Products, Inc., Bedford,



Ohio, makers of Lempco brake drums, axle shafts and other products. It is called the "Lempco Lathe."

The new lathe will carry a heavy truck wheel of 720 lbs. without the aid of tailstock or supports. It is also said to be able to machine a flywheel in less than 12 minutes. It can handle and recondition brake drums from the very smallest of passenger cars to the heaviest of trucks and buses and has been constructed to fill the requirements of the jobber, the brake specialist and the fleet operator.

Some of the features as pointed out by the maker follow: automatic feed and stop; three-speed drive; ¾ h. p. Peerless motor; weighs over 1400 lbs.; small floor-space required; refaces differential housings and Ford flanges; can be adapted to ream pistons.

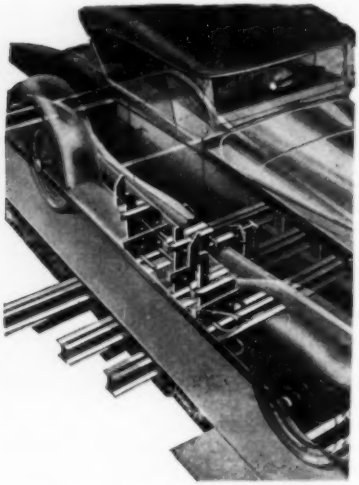
The double-purpose feature that combines both brake-drum and flywheel work means double usage at a minimum investment. A postcard with your name and address on it will bring complete details to you, including price, terms and attachments. Address: Lempco Products, Inc., Bedford, Ohio, or the Editor of this publication, who will see that you are promptly supplied with complete literature.

Free Piston Ring Size Book

A NEW piston ring specification book, 1931 edition, has just been announced by The Perfect Circle Co., Hagerstown, Ind. As in former editions, the book carries a complete description of all types of piston rings; complete price information; best methods for installations; telegraph code; and up-to-date specifications for all passenger car, truck, bus, tractor, motorcycle, marine and airplane motors. Free copies sent on request. Write to the Editor, or to the Company.

Bear Frame Straightener

A NEW frame straightener has recently been marketed by Bear Manufacturing Company, Rock Island, Ill. It consists of a pair of parallel 14-inch runways, each 17 ft. long and an inclined approach to the runways. The latter is demountable, to save space in the shop when not being used.



From the runways are suspended three pairs of sliding brackets, through which are passed transverse I-beams; on these, vertical abutments are mounted. The latter are movable to any portion of the runways and can be securely locked in place.

The actual bending pressure desired to apply to the frame of the car or truck is obtained by powerful hydraulic jacks, set horizontally between the abutments and that part of the frame to be straightened.

Both brackets and I-beams may be moved forward or backward to any desired position. Thus the frame straightener is quickly set up for any desired lateral bending operation. Diamond-shaped frames can be handled by a rearrangement of the I-beams and abutments. All bending operations are checked with Bear gauges as the pressure is applied. The Bear axle press can also be mounted on the frame straightener, to straighten twisted axles without heat and without removing same from the vehicle.

Catalogs on the above, as well as a new "Manual of Wheel and Axle Alignment," which is virtually a text-book on the subject, can be obtained free of charge by addressing the Editor, or the Bear Mfg. Co., Rock Island, Ill.

New Downdraft Carburetor

A NEW downdraft model carburetor of the positive-action type has just been brought out by the Bendix Stromberg Carburetor Co., South Bend, Ind., subsidiary of Bendix Aviation Corp. It is known as the DXR.

This carburetor consists of a pump which delivers an accelerating charge immediately after the throttle is opened and meters and delivers this charge over a definite period of time. An economizer which insures a lean and economical mixture at normal driving speeds automatically supplies the richer mixture necessary for maximum power, high speed and part throttle while accelerating. Idle and low speed jets are below the throttle. The relief valve in the choke valve prevents over choking.

The DXR is mounted on the manifold and the fuel flows past the throttle valve at the bottom and down into the manifold.

Hall Boring Bar

ANNOUNCED some time ago, the new Hall Boring Bar, a portable reconditioning machine, is meeting with enthusiastic success throughout the country, according to the manufacturers, the Hall Manufacturing Co., Toledo, Ohio, makers of the popular Hall cylinder hones and other equipment.

This reconditioning machine will rebore the cylinder, reverse itself and return the cutter head to the top of the cylinder and stop the motor, all of which is accomplished by means of an automatic stop. This feature permits the operator to go on with other work after the cut is started, the only attention required being to move the equipment from cylinder to cylinder as each successive cylinder is rebored.

The cutter head is of the 6-blade type having micrometer adjustment without being removed from the bar, since the adjusting ring is located above the cutter head. Cutter heads are available in diameters which give this machine a range of from 2 1/16 to 5½ inches, although the entire passenger car range calls for but two heads.

The entire equipment is built for accurate work, has long, split-type tapered bearings, adjustable top and bottom; two speeds, 20 and 30 r. p. m. and a selective gear box, providing feeds of .085", .035" and .020" per revolution. Standard equipment includes a ¼ h. p. 110-volt motor, although other types are available. Complete descriptive literature and prices can be obtained directly from the Editor, or from Hall Manufacturing Co., Toledo, Ohio.

Fitzgerald Gasket Sets

GASKETS in complete sets bearing the popular "Fitzgerald" trade-mark are now available for nearly all popular cars and include those gaskets most often used in overhaul jobs, carbon scraping, valve grinding and bearing adjustments.

These complete sets are neatly packaged in heavy corrugated folders, the idea being to buy the set intact, and not broken. Included in these combination sets are such gaskets as cylinder head, oil pan, manifold, valve cover, water outlet, carburetor intake and other gaskets that are used in the particular job in hand.

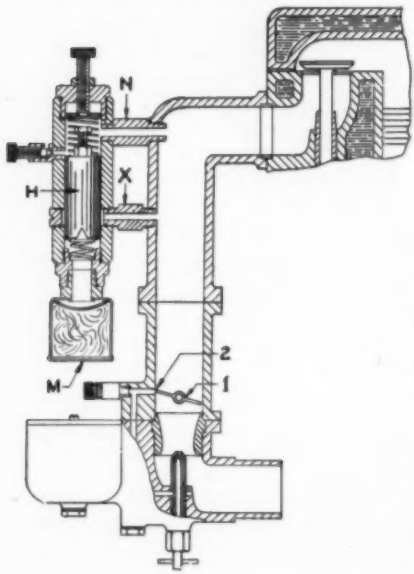
For folder and price-list concerning these new sets, address Fitzgerald Manufacturing Co., Torrington, Conn.

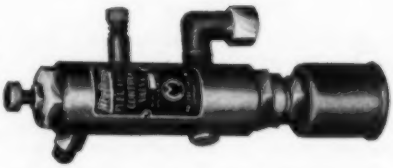
Mallory Fuel-Control Valve

A NEW and interesting device that offers many advantages in motor operation is announced by Mallory Electric Corp., Toledo, Ohio, makers of ignition apparatus bearing that name.

The new product, called the "Mallory Fuel-Load Control Valve," and illustrated herewith, consists of an automatically operated mechanism that regulates the fuel mixture to suit variable speed and load conditions encountered in everyday operation of automotive vehicles.

The valve is connected to the manifold in two places. The nipple (N) is screwed into the upper part of the valve and into the manifold. A connection is made, indicated at X, to the lower part of the valve





and into the center of the manifold just above the carburetor throttle. The operation of the valve is as follows:

Suppose the engine is traveling at twenty-five miles an hour and the throttle valve (1) is suddenly closed. The vacuum increase causes the piston (H) to raise, which permits air to flow through the air cleaner (M) into the valve and out through connection (X) into the manifold. This air by-passing the idle jet (2) tends to reduce the vacuum and raise the compression in the engine. The added air to the rich idle gas makes a more combustible mixture, which gives the engine greater power when operating under a light load or on deceleration.

By utilizing the raw gas being drawn in under light loads and upon deceleration for power, instead of permitting it to go through the engine in a raw state, the car is given a smooth-riding effect, to a great extent, to that of "free wheeling."

Other advantages pointed out by the maker include the elimination of surges caused by the vehicle "crowding" the engine on deceleration and the engine taking up the backlash on acceleration. More important, perhaps, are the savings in gasoline and oil which may be expected, according to the manufacturer. Interesting folder will be sent free on request.

Modern Maintenance
(Continued from page 18)

atmospheric temperatures in country-wide distribution. The foregoing comments will serve as illustrations of some of the methods for obtaining economies by fitting equipment to specific operating conditions that can be accomplished by maintenance engineers.

Competition in bus transportation makes it necessary for bus men to scrutinize their operating costs in order to effect even the smallest economies that will collectively make it possible to earn a profit. It is not unusual to see bus operating costs analyzed to the 4th decimal.

The bus operations under Mitten Management total annually over 17,000,000 miles. With this mileage, one in the 4th decimal represents $1,700.00 per year. Tire costs are figured to the 5th decimal.

I shall undertake to describe some of the accomplishments in "Maintenance Prevention Methods" in Philadelphia territory.

Lamp Life: A study of the life of lamp bulbs in one of P.R.T. operations indicated that under certain operating conditions the voltage in the lighting system was above the rated voltage of the lamp manufacturer. Changes in the charging rate of the generator were made so that at no time was the rated voltage of the lamp bulbs exceeded and a very material increase in lamp life was obtained, resulting in a reduction of lamp renewal costs.

Lamp Shades: The theft of lamp shades from the interior of the buses by passengers as an item of maintenance may be open to question but as the Maintenance Dept. lost the decision in an argument with the Transportation Dept., it was up to them to do something about it. The shades in question were bowl shaped, about 3 inches in diameter at the top. They seemed to be desirable as ash trays and were disappearing at the rate of 380 per month and cost 25c each. We had special molds made with the monogram P.R.T. molded in the bottom of the shade. The price was reduced to 10c each, but the monogram seemed to make them more desirable and accelerated their disappearance. Finally special wooden blocks were made and installed inside the shade which made it necessary to use a screw driver to remove them. The rate of loss was reduced 65%.

Removal of Wheels: It is the practice of many shops to remove wheels and hubs so that an inspection of the brake rigging, bearings, etc., can be made. This practice seems to be unnecessary and adds to the accident hazard, as each time wheels are removed from tapered axle shafts there is wear upon the shafts and probable stretching of the hubs. When working from racks or pits underneath the vehicle, inspections can be made of the condition of the brake lining and brake rigging and the condition of the bearings can be determined by experienced men through testing for looseness and roughness when the wheel is turned by hand. A saving in labor can be effected by intelligent inspection.

Repairs to Broken Chassis Frames: In one of the Philadelphia bus operations we had an epi-

demic of broken chassis frames. The customary procedure in such a case was to remove the bus body from the chassis in order to make repairs. Due to the necessity of keeping the vehicles in service, it was found possible to jack up both sides of the broken frame so that they were in correct alignment, fit a 5/16" plate to the inside of the channel and a similar plate on the outside. By electric-welding the two plates to the frame across the fracture, a satisfactory repair job is made without disturbing the body and at considerably less cost. Some of these repairs have been in service for more than a year with no indication of failure.

As improvements are made in various component parts of commercial vehicles, it is sometimes economical to do constructive maintenance by applying the improved parts to existing equipment.

Adapting Balloon Tires to Old Equipment: The development of the balloon tire for heavy duty service and the satisfactory application of this type of tire to the motor buses now being manufactured has brought about competition which is not favorable to the existing bus equipment. It was, therefore, considered advisable to equip some of the older vehicles with balloon tires in order to provide vehicles with easier riding qualities and also to reduce maintenance cost. For instance, a single-deck bus which was originally equipped with 38 x 7 high pressure tires is now equipped with 9.00 x 24 balloon tires. The difference in dimensions of these tires was not sufficient to make necessary major changes in the construction of the bus. The comparative dimensions are as follows:

Tire Size	Cross Section	Height	Pressure
38 x 7	8"	40.6"	90 lbs.
9.00 x 24	9"	42.2"	55 lbs.

The changes necessary to apply these tires are:

1. Increase the set of the rear springs to raise the body 1½";
2. Install spacers underneath the rubber bumpers mounted on the frame over the rear axle, so that the rubber bumper would strike the axle housing before the tires rub the top of the wheel arches;
3. Install a 1" spacer between the dual rear wheels.

It has been our experience that balloon tires as compared to the high pressure tires running in the same service, over the same routes will average 75% higher tire mileage. Another double-deck bus is equipped with 9.75 x 20 balloon tires on the front wheels and 9.75 x 24 balloon tires on the rear wheels. These tires replaced 36 x 8 high pressure tires on the front wheels and 40 x 8 high pressure tires on the rear wheels. Comparative dimensions are as follows:

Tire Size	Cross Section	Height	Inflation Pressure
36 x 8	9.23"	38.7"	100 lbs.
9.75 x 20	10.02"	39.68"	70 lbs.
40 x 8	9.2"	42.7"	110 lbs.
9.75 x 24	10"	44.2"	70 lbs.

This is the first double-deck bus so equipped and we have not had sufficient operating experience to know or estimate the difference in average tire mileage between the high pressure and the balloon tires on vehicles of this type.

Changing Seats According to Seasons: Chartered coach business has increased to such an extent that it has become a real problem to supply parlor coach equipment to meet this service. One of the companies operated by Mitten Management has equipped six City-

type buses with parlor coach seats of the most improved type with mohair upholstery. It is planned to remove these seats in the Fall of each year and replace them with standard City type seats with leather upholstery for winter operation. This scheme has the advantage of improving the annual load factor of the coaches and permits the filling of orders for parlor coaches without purchasing new equipment which would probably be idle a greater part of the winter months.

I believe that in the last few years a great deal has been accomplished in bringing the designing engineers of motor coach manufacturing and the maintenance engineers of the operators closer together with the result that each has a better understanding of the others' problems, but there are many measuring devices and various special equipment which have been developed by manufacturers through their research departments and production engineers which would be of great assistance to maintenance engineers if placed at their disposal.

I am a staunch advocate of an exchange of engineering knowledge and personnel between the manufacturers and operators for the mutual benefit of both. We have a particular case where such an exchange of engineers was made in one of our bus operations which has proven most satisfactory from the standpoint of both manufacturer and operator.

It is generally recognized that one of the greatest factors in the development of high pressure pneumatic tires and balloon tires is the tire mileage contract under which the tire manufacturer assumes all maintenance expense.

I offer as a suggestion to stimulate the development of the motor coach and to very materially reduce maintenance cost, *motor coach mileage contracts* with *motor coach manufacturers.*

Oil Filter Replacement

CARRYING an approved product into an entirely new field, the Handy Governor Corporation has begun volume deliveries of the Handy Oilfiltor to its whole organization of more than 100 distributors. Heretofore, Handy has been active in the oil filter field only as a builder of equipment. With this new departure, the company becomes a source of supply for replacement filters.

Months of study by Handy engineers have produced a degree of simplification in a filter replacement stock. With only two Oilfiltor units, and five little kits of fittings, a service station becomes able to supply replacement on 90% of all motors carrying filter equipment, as well as new installations on cars not filter-equipped by the manufacturers.

The replacement Oilfiltors are identical, in principle and operation, with those which Handy supplies to several well known motor car builders as standard equipment. The filtering element is thick felt. Construction is sturdy and capacity generous. Requests for literature should be sent to Handy Governor Corporation, Detroit, Mich.

Rear End Servicing
(Continued from page 32)

support the gears properly and it is poor economy to reinstall such bearings.

Under no circumstances should a new set of differential drive and pinion gears be fitted until the cause of breakage or failure of the old gears has been determined and corrected.

The careful mechanic will make a thorough inspection of all the related parts in the rear axle when called upon to make a drive and pinion gear replacement.

Unfortunately there are instances where the rear axle is re-assembled without an adequate inspection and without replacement of such parts as might cause a recurrence of gear failure within a comparatively short time after the job is delivered to the driver.

Both the repair shop and the owner lose on a job of this kind. Take nothing for granted on a drive and pinion gear installation. Get everything right *before* re-assembly and the chances of a "come-back" are eliminated.

Before any attempt is made to rivet a new ring gear to the differential case flange, the case should be tested to see if the flange runs perfectly true with the bearing hubs of the case.

This is done by supporting the case between centers in a lathe (Figure 2) or on a differential truing machine (Figure 3) and testing it for run-out. Make sure the centers of the case are true with the bearing-fit on the case hubs before turning down the flange. Sometimes the centers become marred or mutilated. If such a condition cannot be corrected, it is necessary to chuck one hub true in the lathe and run the other hub in the steady rest of the lathe. The hubs should run true under .002 in. to true up the differential case flange. If the flange does not run true, one or more light cuts should be taken over the face of the flange until the run-out is not over .002 in. as checked by the dial indicator. When this condition is attained the case flange is ready for receiving the new gear.

The pinion shaft also should be tested between lathe centers for run-outs. There should be not more than .001 in. run-out at any of the bearing surfaces of the pinion shaft. This testing applies to pinion shafts of all types.

When the time comes for replacement of drive and pinion gears, the best practice always is to replace *both* gears, even though one or the other has not been actually broken, and may appear to be in good condition.

Some mechanics, in the belief that they are actually saving time and money for the company, replace only the gear which has been broken, whereas it is actually more economical to replace both with a mated set.

Except in very rare cases, a new pinion cannot be made to run quietly and properly with an old ring gear, or vice versa. The appearance of a drive or pinion gear has little to do with its adaptability for further use, for the natural tooth contour or shape may be broken down by the unnatural wear that comes just before or after the gear failure.

Similarly, it is difficult to get a good job when using both drive and pinion gears which are new, but

which have not been mated.

The mechanic who replaces both gears with a set of mated gears eliminates practically all of the trouble ordinarily experienced in obtaining proper adjustment.

In order to insure quiet operation of the differential drive gears, even when mated gears are used, the axis of the pinion shaft and differential case *must* be at right angles to each other. (See Figure 4.)

Before riveting the ring gear to the differential case it is advisable to bolt the gear to the case flange with four bolts. These bolts should be placed in holes at quartered positions so that when the nuts are drawn tight the gear will be pulled evenly against the flange. (See Figure 5.)

Tighten the nuts of the four bolts by hand and then use a wrench, giving each nut a slight turn. By working on opposite pairs the nuts will be tightened uniformly and the gear held perfectly flat against the case flange.

Test the gear to see that it is true against the case flange within .002 in. by revolving it in a lathe. Use a dial indicator on the back of the gear.

With the gear held in place by the four bolts as shown in Figure 5, it is ready for the riveting operation.

Two holes, on opposites sides, are riveted first. After the third and fourth rivets are placed (which should be at quarter positions around the bolt circle), the four bolts can be removed and the rest of the rivets installed.

When the job is in proper condition for riveting, this operation is best done in the riveting fixture described for forcing out the old rivets.

Riveting cold, under pressure from a large press, first expands the *body* of the rivet, thus making a very tight fit before the end of the rivet is headed.

The different results obtained by hot and cold riveting are shown in Figure 6. Hot riveting contracts when it cools and the rivet draws away from the sides of the hole, making it possible for the rivet to work loose in service.

With the riveting fixture shown in Figure 7, interchangeable punches and dies are usually furnished to handle oval or flat head rivets from one-quarter to one-half inch inclusive. The punch is held in perfect alignment with the lower die, thus preventing the rivet from getting out of line when pressure is exerted from the press. Also, in such a fixture the punch is held at the desired height under spring tension while turning the gear to insert a new rivet. The differential assembly is held level by two adjustable screws, one of which is shown in Figure 7.

If a garage press and riveting fixture are not available the mechanic must employ the old method of rivet set and hammer. At least three sizes of rivet sets should be on hand—and should be kept for setting ring gear rivets only. This job should never be done with just a hammer without a rivet set. A riveting anvil for this job should be so built that it fits snugly over the jaws of the vise, or, better yet, in the hardy hole of an anvil. This riveting anvil must of course be made to conform to the shape of the rivet heads used.

Where the riveting is to be done by this hand method, it is absolutely essential to have a heavy rivet set

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Rear End Servicing

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and good anvil if a satisfactory job is to be obtained.

Hot riveting should be done only as a last resort, for it does not always insure a satisfactory job.

This work can be done much more quickly—and with assurance that the ring gear is evenly drawn against the flange of the case—by the use of a press and riveting fixture.

If the pinion gear is of the bored type (that is, not integral with the shaft), it is very important that it be correctly mounted on the pinion shaft. The proper mounting of a bored-out and keyed-on pinion is shown in Figure 8.

The key must be a good fit in the key-way of both the shaft and pinion. There must be a slight clearance between the bottom of the key-way in the pinion gear and the top of the gear itself. If the pinion gear "rides" the top of the key, the resulting pressure will almost always cause the pinion to break.

(Editor's Note:—More of this interesting treatise on rear axle gear installation will appear in our next issue. In the subsequent article we will present the balance of the text which gives detailed instructions for the proper adjustment of drive and pinion gears after they have been installed. Watch for the article! If you prefer to have the complete article in booklet form, a free copy may be obtained by writing to Automotive Gear Works, Richmond, Ind., or to the Editor of this publication.)

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